THREE NEW SPECIES OF *GEKKO* AND REMARKS ON *GEKKO HOKOUENSIS* (LACERTIFORMES, GEKKONIDAE)

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TRANSLATORS' NOTES

In preparing the English version from the original (in Chinese, with English summary), we attempted to make as literal a translation as possible. However, a few minor changes were made with footnotes (* – ****); these footnotes follow the references. Locality names were written in Continental spellings, followed by Taiwanese spellings in parentheses at their first appearance.

We thank R.I. Crombie and G.R. Zug for their assistance and encouragement during the process of preparation of the present manuscript.

INTRODUCTION

Among the gekkonid genera occurring in China, *Gekko* is the largest group with the widest range of distribution. Six species and two subspecies have hitherto been known for the genus from China (Stejneger, 1932; Chen, 1969). During 1975 to 1980, Department of Biology, Nanjing Normal College collected 1637 specimens of *Gekko* from Hebei (Hopei), Shanxi (Shansi), Shaanxi (Shensi), Shandong (Shantung), Henan (Honan), Jiangsu (Kiangsu), Anhui (Anhwei), Hubei (Hupeh), Sichuan (Szuchuan), Zhejiang (Chekiang), Fujian (Fukien), Jiangxi (Kiangsi), Hunan (Hunan), Guizhou (Kweichow), Yunnan (Yunnan), Guangdong (Canton), Hainan (Hainan)*, and Guangxi (Kwangsi) Provinces. Several specimens were also collected from Guizhou Province by Department of Biology, Zunyi Medical College. While studying these specimens, three new species were discovered. On the other hand, *Gekko japonicus hokouensis* from Yanshan (Chainshan) Prefecture, Jiangxi Province, proved to represent a good species. Consequently, ten *Gekko* species** are presently recognized from China as follows:

Key to species of *Gekko* in China

1. Rostral separated from nostril 2
Rostral in contact with nostril 3

2. Body relatively large, longer than 200 mm in total length; tubercles not particularly concentrated in upper margin of ear opening .... *G. gecko*
Body relatively small, shorter than 150 mm in total length; upper margin of ear opening with cluster of enlarged conical tubercles concentrated in high density ....*G. auriverrucosus* sp. nov.

3. Male with 24 femoral pores in each side .... *G. kikuchii*
Male with preanal, or preanal-femoral pores 4

4. A single enlarged spur on each side of base of tail 5
Enlarged spurs, two to three, with slight variation, on each side of base of tail 8

5. Webs between digits evident 6
Webs between digits very slight or absent 7

6. Tubercles absent on dorsum of body; male with 7-11 preanal pores .... *G. subpalmatus*
Tubercles present on dorsum of body; male with 17-27 preanal pores............... *G. chinensis*

7. Supranasals in contact; dorsal tubercles flat; head and body length reaching 80 mm ....
.... *G. liboensis* sp. nov.
Supranasals separated by a small scale; dorsal tubercles relatively convex; head and body length not greater than 70 mm .... *G. hokouensis*

8. Granular scales on dorsum of body relatively large; dorsal tubercles flat, in low density ....
.... *G. swinhonis*
Granular scales on dorsum of body relatively small; dorsal tubercles relatively convex, in high density 9

9. Dorsal surfaces of body, thigh, and shank with much enlarged tubercles ....
.... *G. scabridus* sp. nov.
Tubercles moderately enlarged in dorsal surfaces of body and shank, usually lacking in thigh...
.... *G. japonicus*

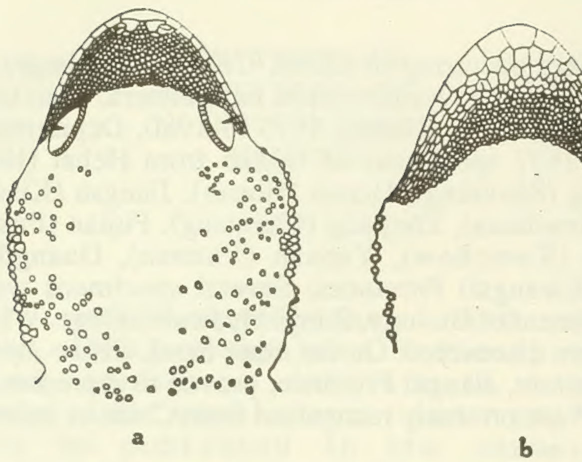

Fig. 1. *Gekko auriverrucosus* sp. nov. a. Dorsal view of head; b. Ventral view of head.

Gekko auriverrucosus **Zhou et Liu sp. nov.** (Plate I: 2, Fig. 1)

Holotype—Male (NNC 80275), collected from Hejin (Hojin) Prefecture, Shanxi Province (alt. 459 m), on 19 August 1980. Allotype: female (NNC 80243), collection date and locality as for holotype. Paratypes: 33 males and 41 females, collected from Hejin, Yongji (Engtsi), and Linyi (Linyi) Prefecture, Shanxi Province. Collector: Xin-rong Xu. Type specimens are deposited in Department of Biology, Nanjing Normal University.

Diagnosis—Rostral separated from nostril; upper margin of ear opening with cluster of enlarged conical tubercles gathering in high density; tubercles uniformly scattered in temporal and occipital regions, neck, and dorsal surfaces of body, base of tail and limbs; male with 8-11 preanal pores.

Description—Snout about twice as long as eye diameter, distinctly longer than distance between eye and ear opening; diameter of ear opening 0.9-1.5 mm, about 30-44% of eye diameter; rostral twice as broad as high, angulated at midpoint dorsally, separated from nostril; nostril surrounded by first supralabial, supranasal, and two small scales; supranasals moderately enlarged, slightly longer than broad, separated from each other by a minute scale, or in contact with each other medially; supralabials 9-11; infralabials 9-11; mental pentagonal; chin shields forming several rows of transverse arches; first row normally comprising five shields, each slightly longer than broad, median three largest; scales following chin shields and reaching gular region uniform, granular (Fig. 1).

About 12 scales between nostril and eye; interorbital scales about 25; upper margin of ear opening with tubercle cluster comprising about six enlarged conical tubercles gathering in high density; around jaw angle and preotic region also with enlarged conical tubercles; tubercles uniformly scattered among dorsal granular scales, from temporal and occipital regions to base of tail, in 16-20 irregular rows at midbody; dorsal surfaces of forelimbs covered with small tubercles; on dorsal surfaces of hindlimbs, tubercles scattered among granular scales; scales granular in gular region, imbricate in the other part of ventral surface of body; webs between digits rudimentary; underneath dilated portions of toes with lamellae, 6-8 on toe I, 6-8 on toe II, 6-8 on toe III, 6-8 on toes IV, and 7-9 on toe V; male with 8-11, mostly 8-9 preanal pores.

Table 1. Measurements (in mm) of specimens of *Gekko auriverrucosus*.

Specimens	Total length	Eye diameter	Diameter of ear opening	Snout length	Head length	Axilla groin length	Fore-limb length	Hind-limb length
Holotype (NNC 80275)	125.5 (62+63.5)	3.2	1.2	6.7	15	28	18.5	24.5
Allotype (NNC 80243)	135.5 (65.5+70)	3.3	1.3	7.3	16	30.5	19	27
Paratypes								
11 males from Hejin	119 (59+60)-130 (63+67)	3-3.5	1-1.3	6.3-7	14-16	25-29.5	16-19	24-25
16 females from Hejin	117 (56+61)-133 (65+68)***	3-3.6	1-1.5	6.4-7.5	14-17	27-33	16.5-20	23-28.5

Tail slightly compressed, with two or three enlarged spurs in each side at base; dorsum of tail covered with tubercles of various sizes; annular grooves in about every sixth to eighth tubercle; venter of tail with a longitudinal row of laterally elongated shields.

Dorsal ground color of preserved specimen pale gray; a brown bar from nostril through eye and ear to shoulder; top of head with brown markings; dorsal surfaces of neck and body with 5-6 transverse brown bands; dorsum of tail with 9-13 transverse brown bands; posterior edge of transverse bands in body and tail darkly edged; dorsal surfaces of four limbs also with transverse brown bands; venter of body light reddish yellow.

This new species might be easily misidentified as *G. japonicus*. However, the latter species has a rostral entering the nostril, and lacks a cluster of tubercles in the upper margin of the ear opening. Thus, *G. japonicus* is actually distinct from the present new species.

In the natural habitat, the density of *G. auriverrucosus* is very high. It prefers to perch on high portions of walls, and occasionally appears on artificially lighted areas to search for prey. In June and July, the present species has its reproductive season. Juveniles collected between 19 and 22 August had already reached 31-32.5 mm in head and body length. All adult females collected on the same date from the same locality with the above juveniles possessed no mature eggs. About 1/6 of the total sample had parasitic mites, especially in high density on digits.

***Gekko liboensis* Zhou et Li sp. nov.** (Plate II: 1, Fig. 2)

Holotype—Female (TMC 791669), Chengguan (Chengkwang), Libo (Libo) Prefecture, Guizhou Province (alt. 430 m), on 5 July 1979, by Zhi-lu Zhao. This specimen is deposited in Department of Biology, Zunyi Medical College.

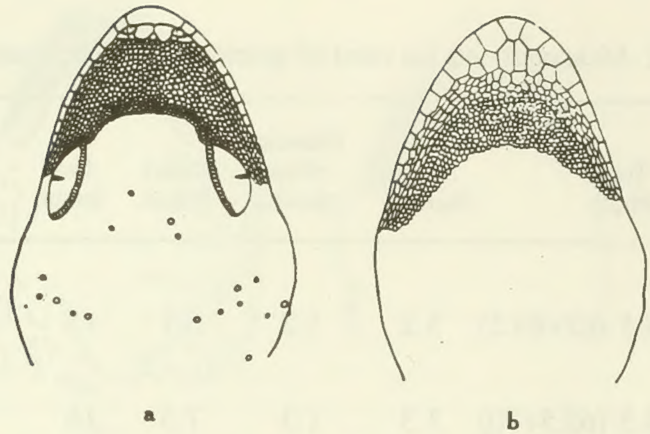

Fig. 2. *Gekko liboensis* sp. nov. a Dorsal view of head; b. Ventral view of head.

Diagnosis—Head and body length exceeding 80 mm; supranasals large, in contact with each other medially; flat, cycloid tubercles among dorsal granular scales, forming about 10 irregular longitudinal rows; webs evident between fingers I, II and III, very slight between fingers III, IV and V.

Description—Holotype very large, head and body length nearly 85 mm; snout 1.8 times as long as eye diameter, distinctly longer than distance between eye and ear opening; diameter of ear opening 2 mm, about 40% of eye diameter; rostral broader than deep, upper margin slightly concaved at midpoint; nostril surrounded by rostral, first supralabial, supranasal, and two small scales; supranasals large, in contact with each other medially; supralabials 12; infralabials 11; mental triangular; median pair of chin shields twice as long as broad, posteriorly entered by a pair of small polygonal chin shields (Fig. 2).

About 18 scales between nostril and eye; interorbital scales about 40; flat, cycloid tubercles uniformly scattered in low density on dorsum, from parietal and occipital regions to base of tail, forming about 10 irregular rows on body; fore- and hindlimbs without tubercles; ventral surface posterior to neck covered with imbricate scales; 10 enlarged scales in preanal region.

Underneath dilated portions of fingers covered with lamellae, eight on finger I, eight on finger II, nine on finger III, nine on finger IV, and eight or nine on finger V; rudimentary webs evident

Table 2. Measurements (in mm) of a specimen of *Gekko liboensis*.

Specimens	Total length	Eye diameter	Diameter of ear opening	Snout length	Head length	Axilla groin length	Fore-limb length	Hind-limb length
Holotype (TMC 791669)	121.8 (84.8+37) (regenerated tail)	5	2	9.2	21	37	25.2	35

between fingers I, II and III, faintly between fingers III, IV and V; margins of webs attaching to proximal one third of toes; hindlimb much developed, its length 95% of axilla to groin length; underneath dilated portions of toes covered with lamellae, eight on toe I, seven or eight on toe II, eight on toe III, nine on toe IV, and nine on toe V; rudimentary webs evident between toes I, II, III and IV; a single large spur on each side of base of tail; tail regenerated, very short.

Dorsal ground color in preservative grayish tan; a brown bar running along lower margin of eye, almost reaching to ear opening posteriorly; dorsal surfaces of neck and body with nine transverse brown bands; dorsal surfaces of limbs also with transverse brown bands; venter of body pale reddish yellow.

This new species greatly resembles *G. hokouensis*. However, the latter has supranasals separated from each other, and conical dorsal tubercles. Moreover, the head and body length of *G. hokouensis* is shorter than 70 mm.

G. liboensis is rarely observed at Chengguan, Libo Prefecture.

Gekko hokouensis Pope

Gekko japonicus hokouensis Pope, 1928, Amer. Mus. Novitates 325: 1-2 (Yanshan Prefecture, Jiangxi Province)

Pope (1928) regarded this form as a subspecies of *G. japonicus*, and stated that *G. j. hokouensis* differs from the nominal subspecies only in the number of cloacal spurs; he noted that the former has a single spur on each side of the base of tail, whereas the latter has two or three spurs. While investigating a large series of specimens, we found that *hokouensis* has a relatively large spur, measuring about 2.2-3.1 mm for the male and 1.3-2.0 mm for the female in maximum diameter. Although the spur is more or less grooved and incompletely divided in a few males and most females, the outline of the single spur remains apparent in all animals (Plate II: 4-9). On the other hand, *japonicus* possesses two or three smaller spurs below three larger spurs. The size of each spur is relatively small, and the maximum diameter of the largest spur measured 1.2-1.5 mm in the male and 0.6-1.0 mm in the female (Plate II:10-11). Differences are recognizable between *hokouensis* and *japonicus* also in the condition of dorsal tubercles as follows. In *hokouensis*, tubercles are absent on the four limbs, and relatively few around the middle of the body. On the other hand, in *japonicus*, the dorsal surface of the forearm and shank is covered with tubercles, and the tubercles around the middle of the body are in relatively high density (Plate II:2-3, Table 3).

Table 3. Comparison of dorsal tubercles in *Gekko hokouensis* and *G. japonicus*.

Species	N	Localities	Occipital and neck	Body	Upper arm	Forearm	Thigh	Shank
Gekko hokouensis	271	17 locations in six provinces	- / +	+	-	-	-	-
Gekko japonicus	747	50 locations in 12 provinces	+	++	-	+	- / +	+

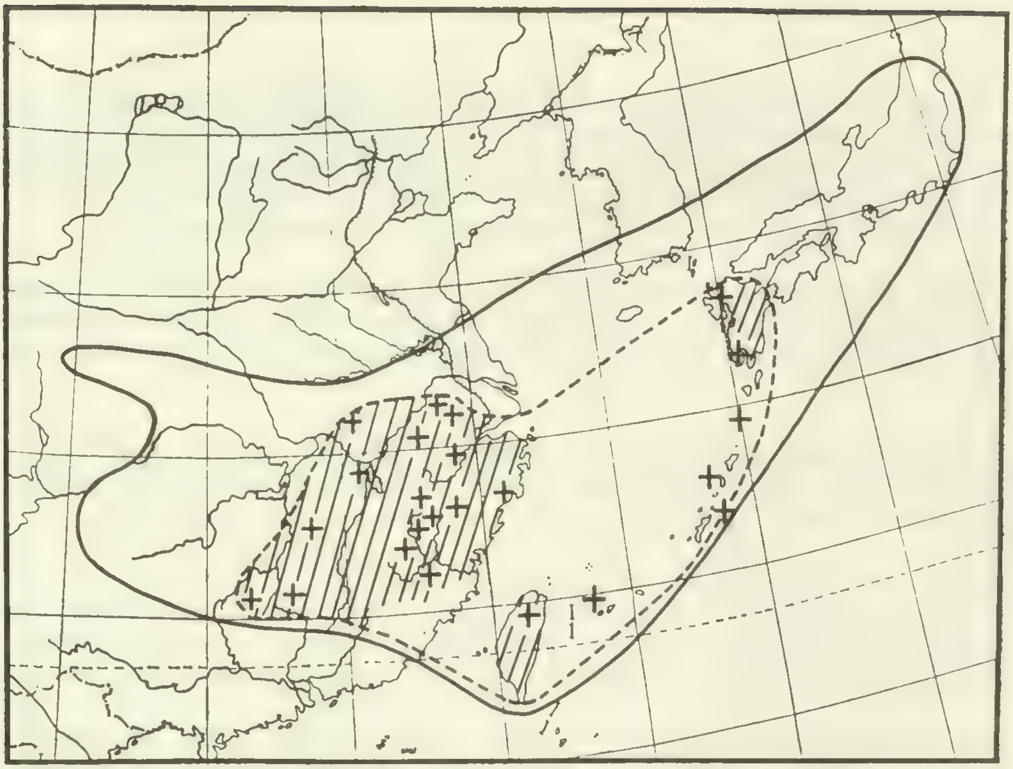

Fig. 3. Distributions of *Gekko hokouensis* and *Gekko japonicus*. Ranges of the former and the latter are outlined by broken and complete lines, respectively. Cross-marks indicate localities of specimens of *G. hokouensis* cited in the present study****.

On the basis of the above characteristics, we identified 271 specimens out of 1018 of *G. japonicus* (sensu lato) as *hokouensis*, and the remaining 747 as *japonicus* (sensu stricto). The former specimens were collected from 17 prefectures of six provinces, and the latter from 50 prefectures or cities of 12 provinces. The sampling localities of *hokouensis* are scattered within the range of *japonicus* (Fig. 3).

Conditions of natural habitats also differ between these two gekkonids; while *hokouensis* has its habitat in montane environments, *japonicus* is widely distributed in cities and villages of the plain regions. In Jiujiang (Kiukiang) City, for example, *japonicus* is found in urban area, whereas *hokouensis* in Lushan-haihui (Lushan-haihui), Bailudong (Bailudong) and Guling (Kuling). In Yixing (Ising) Prefecture, *japonicus* and *hokouensis* occur in the lowland and montane areas, respectively. The mutual displacement between *hokouensis* (a mountain dwelling species) and *japonicus* (a plain dwelling species) around a sympatric area much resembles the displacement between *Eremias brenchleyii* and *E. argus*. However, there are some areas where both of these gekkonids are collected from the same point at the same time. For example, of the 25 specimens obtained within a city of Chong'an (Chungan) Prefecture, on 26-27 June 1978, 15 specimens were identified as *japonicus* and the remainder as *hokouensis*. No intermediate forms were found among the above specimens.

Based on the morphological distinctiveness, sympatric occurrence, and ecological differences, we remove *hokouensis* from the subspecific status of *G. japonicus*, and regard it as a distinct species *Gekko hokouensis* Pope.

Within China, *G. hokouensis* is distributed in Yixing and Lishui (Lishui), Jiangsu Province, Tonglu (Tonglu) (Stejneger, 1932), Longquan (Longchuan), Beiyandangshan (Beiyantangshan), Zhejiang Province, Pucheng (Pucheng), Chong'an, Wuyishan (Wuyishan), Shaowu (Shaowu), Youxi (Yousi), Fujian Province, Taiwan Province (Maki, 1923), Jinzhai (Ginshai; Xuzhou Normal University), Huangshan (Huangshan) and Taiping (Taiping; Chengdu Institute of Biology), Anhui Province, Yanshan, Ninggang (Ningkwang), Lushan, Jiangxi Province, Yizhang (Ichang; Zhengdu Institute of Biology), and Jiangyong (Kiangyong)[1], Hunan Province. In Taiwan, *G. japonicus* has been reported from several localities (Chen, 1969). Maki (1923) described specimens of "*G. japonicus*" from Taiwan as possessing a single process in each side of the base of tail, and limbs covered only with granular scales. These characteristics are identical with those of *G. hokouensis*. Of the specimens of "*G. japonicus*" collected from Japan, some animals such as the one from Nagasaki (USNM 13563; Stejneger, 1907) were reported to have three spurs in each side at the base of the tail, and tubercles on the dorsum of the shank, whereas others such as specimens from Yamagawa (USNM 31821 and 31822; Stejneger, 1907) and Fukuoka (Okada, 1936: fig. 1) possess a single spur and lack tubercles on limbs. Nakamura and Uéno (1963) noted that *G. japonicus* has normally a single but occasionally two or three tubercles, and that some animals possess tubercles on limbs. In October 1981, one of us examined specimens under the care of Dr. Shun-Ichi Uéno at National Science Museum, Tokyo. Of the 21 specimens there, 12 from Tokara Is. (0231, 02287, 02293-95), Tokunoshima I. (0924), Yoronjima I. (0524, 02288-90, 02292) and Iriomotejima I. (0475) were identified as *G. hokouensis*, and the other nine from Tokyo (0236, 02286, 02297-98), Kyoto (02302) and Tsushima I. (0038, 0851, 0853, 02296) as *G. japonicus*. These results indicate that "*G. japonicus*" in Japan actually includes both *G. hokouensis* and *G. japonicus* (sensu stricto).

***Gekko scabridus* Liu et Zhou sp. nov.** (Plate I: 1, Fig. 4)

Gekko sp. Hu Shu-chin, Djao Er-mie and Liu Cheng-chao, 1973, Acta Zoologica Sinica 19(2): 155, from Guiyang (Kweiyang)

Holotype—Male (NNC 80122), Yongren (Yongzen) Prefecture, Yunnan Province (alt. 1531 m), on 4 Aug. 1980. Allotype: female (NNC 80143), collection date and locality as for holotype. Paratypes: 16 males and 33 females collected from Yongren Prefecture, Yunnan Province, and Miyi (Miyi) Prefecture, Sichuan Province. Collector: Xin-rong Xu. Type specimens are deposited in Department of Biology, Nanjing Normal University.

Diagnosis—Tubercles covering dorsal surfaces of body and hindlimbs much enlarged; male with 10-15 preanal pores.

Description—Eye relatively large, its diameter longer than half, as long as 51.4-57.1%, of snout length; snout slightly longer than distance between eye and ear opening; diameter of ear opening 0.9-1.5 mm, about 23-41% of eye diameter; rostral rectangular, its breadth less than twice of height; in a few specimens, upper margin of rostral slightly concave dorsally at mid point; nostril surrounded by rostral, first supralabial, supranasal, and two small scales; supranasals moderately enlarged, slightly broader than long, separated from each other normally by a single scale, but in

[1] All the locality data without citations of authors or institution are based on the specimens deposited in Department of Biology, Nanjin Normal College.

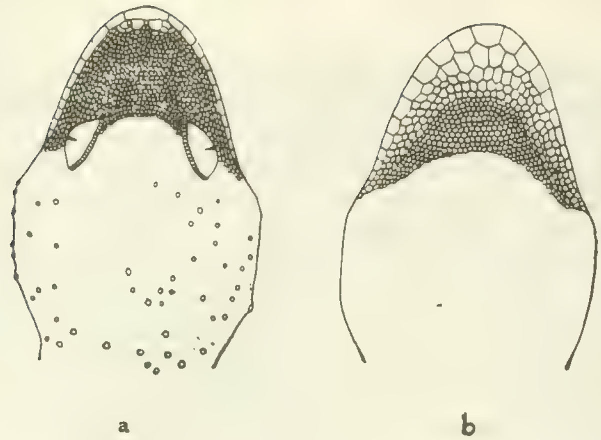

Fig. 4. *Gekko scabridus* sp. nov. a. Dorsal view of head; b. Ventral view of head.

some specimens, by two scales, or in contact with each other medially; supralabials 9-11; infralabials 9-11; mental pentagonal; chin shields longer than broad, median pair largest, outer pair relatively small, continuously graded to small granules through three to four rows of small hexagonal scales (Fig. 4). About 12 scales between nostril and eye; interorbital scales about 30; tubercles scattered among dorsal granular scales in high density, from frontal, parietal, temporal and occipital regions of head to base of tail, in 17-21 irregular rows around middle of body, those on dorsum of body extremely enlarged; limbs covered with granular scales dorsally, tubercles present on limbs except for upper arms; tubercles on hindlimbs distinctly enlarged like those in dorsum of body; venter of body covered with imbricate scales; interdigital webbings rudimentary; underneath dilated portions of digits with lamellae, 6-9 on toe I, 6-9 on toe II, 7-9 on toe III, 7-9 on toe IV, and 7-10 on toe V; male with 10-15, mostly 12 or 13, preanal pores.

Tail slightly compressed, with two or three enlarged spurs on each side at base; only one specimen (NNC 80166) of 51 examined had a single enlarged spur on both sides; dorsum of tail covered with granular scales; annular grooves in about every seventh to ninth row of granules; grooves in proximal one third of tail margined by six to eight enlarged tubercles posteriorly, such tubercles gradually disappearing in remaining portion of tail; venter of tail covered with imbricate scales, median scales enlarged and irregularly arranged, paired or not paired, in distal two-thirds to four-fifths of tail.

Dorsal ground color of preserved specimen pale brown; two brown bars from nostril through eye to temporal region; dorsal surfaces of head, body and limbs with irregular brown spots and reticulations; 7-9 transverse bars on neck and body; dorsum of tail with 10-14 transverse brown bars; venter of body light reddish yellow.

G. scabridus closely resembles *G. japonicus*. However, these species differ from each other as follows. In *G. japonicus*, dorsal tubercles on the body and shanks are distinctly smaller than those in *G. scabridus*, and tubercles are normally lacking on thighs. Moreover, male *G. japonicus* normally has only 4-8 preanal pores.

In the natural habitat, *G. scabridus* occurs in very high densities, and is observed equally in lighted and dark areas of walls. Of the specimens examined, a few animals possessed parasitic

Table 4. Measurements (in mm) of specimens of *Gekko scabridus*.

Specimens	Total length	Eye diameter	Diameter of ear opening	Snout length	Head length	Axilla groin length	Fore-limb length	Hind-limb length
Holotype (NNC 80122)	112.5 (57.5+55)	3.7	1.3	7	15.7	26	17.5	26
Allotype (NNC 80143)	120.5 (58+62.5)	3.8	1.4	7	15.7	27	19	24.5
Paratypes								
11 males Yongren	114 (57+57)- 138 (64+74)	3.7- 4.2	1.2- 1.5	7- 7.5	15.4- 17	25.5- 30	17.5- 20	25- 27
12 females Yongren	116.5 (56.5+60)- 140.5 (63.5+77)	3.5- 4	1.1- 1.5	6.3- 7.3	14.5- 17	25- 30	16.5- 19	24- 27

mites. Juveniles collected in the beginning of August had reached 28-33 mm in head and body length. All adult females collected in the same date from the same locality with the above juveniles had no mature follicles.

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TRANSLATORS' FOOTNOTES

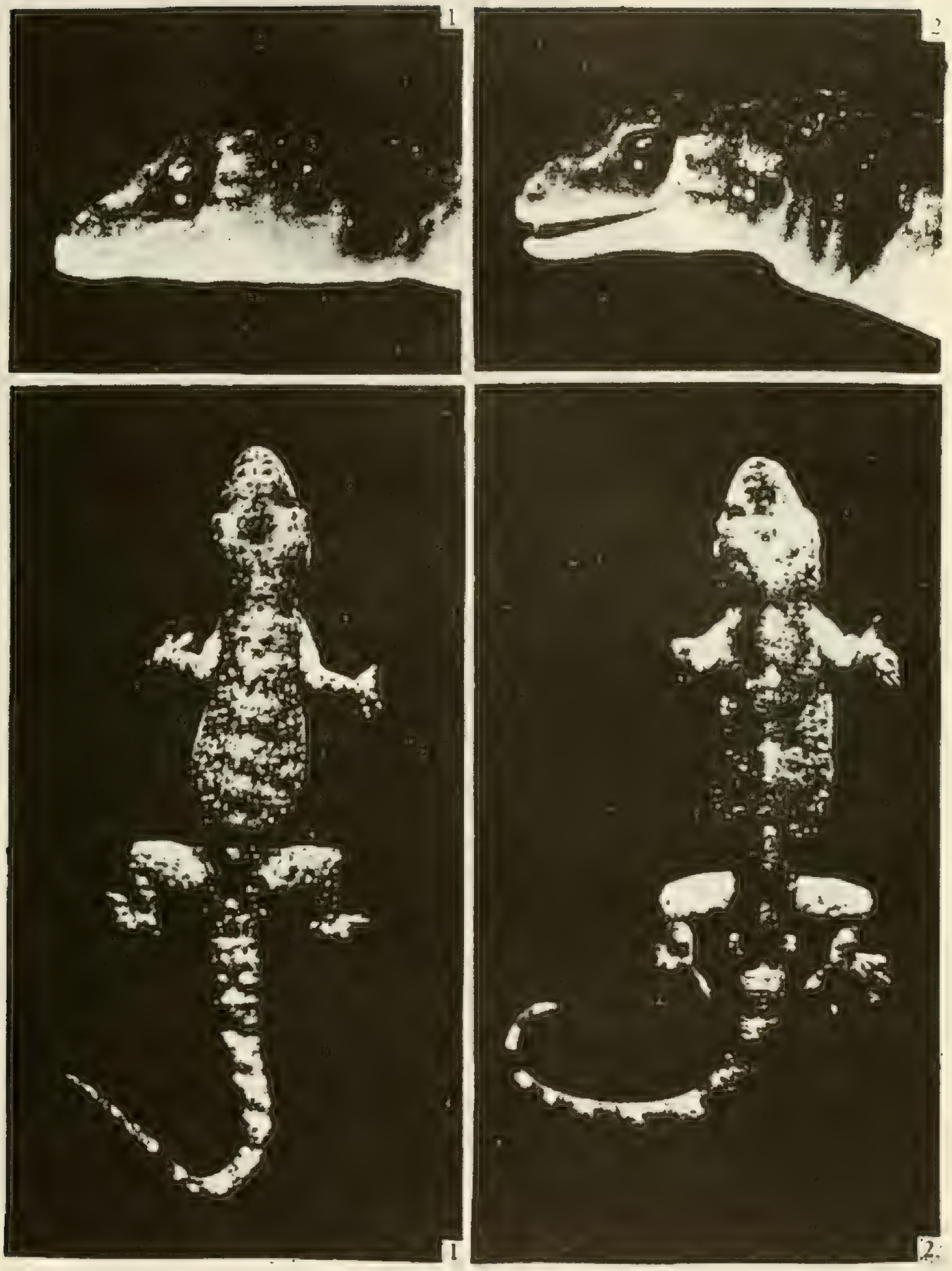
* In the original, Hainan Island was included in Guandong Province. However, this island was removed from the latter to form an independent province, Hainan Province, by itself in 1987.

** The original states "10 *Gekko* species and one subspecies", but it lists only 10 species in the key.

*** Table 1 in the original contains "113 (65+68)", but this must be a typographical error.

**** The figure legend in the original states that the cross-marks in Fig. 3 indicate localities where *G. japonicus* was collected. But it is evident, from the content of the text, that those marks actually represent sampling localities of *G. hokouensis*.

Plate I.



1. *Gekko scabridus* Liu et Zhou, sp. nov. Lateral view of head (above), and dorsal view (below).
2. *Gekko auriverrucosus* Zhou et Liu, sp. nov. Lateral view of head (above), and dorsal view (below).

1. *Gekko liboensis* Zhou et Li, sp. nov. Dorsal view.
2. *Gekko hokouensis*. Dorsal view of base of tail and hind limbs.
3. *Gekko japonicus*. Dorsal view of base of tail and hind limbs.
4-9. *Gekko hokouensis*. Enlarged spurs on right side of base of tail in males (4 and 5) and females (6 to 9). Spurs in 4 and 6 have no shallow furrows, whereas those in the remainders (5, 7, 8, and 9) show more or less developed furrows incompletely dividing the spurs.
10-11. *Gekko japonicus*. Spurs on right side of base of tail in a male (10) and a female (11).

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Let us now praise famous men, and our fathers that begat us. All these were honored in their generations, and were the glory of their times (Ecclesiasticus 44:1).

INTRODUCTION

The history of a science consists not only of the chronology of development of knowledge and ideas, but equally of the life stories of men and women who contribute to that science. For ichthyology and herpetology a significant part of this human record is contained in seventy-five years of the journal Copeia. Unfortunately this rich source of historical and biographical information has been largely inaccessible, as most of the death notices, obituaries, and biographical sketches in Copeia appeared in the "Editorial Notes and News" section of the journal, and are not included in the journal's annual index. This compilation will provide ready access to biographies in Copeia and, hopefully, stimulate an appreciation for the personalities who fostered modern ichthyology and herpetology.

The index consists of three lists: the biographical articles arranged alphabetically by name of subject and keyed to the bibliography by number, an annual list of biographies, and a bibliography. The content of articles is coded as follows: "N" is a death notice only; "B" is a biography; "P" indicates a portrait is included; "L" identifies a biography with a bibliography. The biographies range in length from a few words to several pages. Although the distinction is arbitrary in some cases, the "B" category is reserved for articles that have substantial biographical content. Three major articles in Copeia (Dymond, 1964, (1):2-33; Myers, 1964, (1):34-41; Hubbs, 1964, (1):42-60) are not indexed. Although they contain biographical information, these articles are primarily historical reviews.

Much of the credit for documenting the lives of ichthyologists and herpetologists in Copeia belongs to two of our late colleagues, incidentally also my "scientific grandfathers." The first of these, Carl L. Hubbs, had an unusually strong sense of the importance of the historical perspective. Perhaps this was because his career spanned critical years in the transition to the modern era, as did that of his mentor David Starr Jordan. Hubbs was by far the most prolific contributor of biographical articles to Copeia (24 signed articles and dozens of unsigned notes). Moreover, as first ichthyological editor (1930-1937) of the "new series" of Copeia, he pioneered regular incorporation of biographical information in "Editorial Notes and News." George S. Myers is second to Hubbs in number of biographies published in Copeia, but his contributions are models of sympathetic and insightful biography. To these two, indeed to all who have contributed to this unique record, we owe our gratitude. I thank Alan E. Leviton for (indirectly) suggesting this project, and M. Therése Giles for enduring patience.

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1957- Dunn, Emmett Reid (378); Pietschmann, Viktor (174); Schmidt, Karl Patterson (175).

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1973- Babbitt, Lewis H. (235); Eddy, Samuel (414); Landreth, Hobart (233); Peters, James A. (274); Shiraishi, Yoshikazu (335); Templeton, James R. (234).

1974- Hart, John L. (386); Herald, Earl Stannard (361); Hubbs, Carl Leavitt (342, 365, 391); Loftus-Hills, Jasper J. (1); Pope, Clifford H. (343); Romer, Alfred Sherwood (283); Scortecci, Giuseppe (409).

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170. ___. 1956. Raymond C. Osburn. (1):74. N

171. ___. 1956. Emmett Reid Dunn. (2):137-138. N

172. ___. 1956. Léon Bertin. (2):138. N

173. ___. 1956. E. W. Gudger. (2):138. N

174. ___. 1957. Viktor Pietschmann. (4):331. N

175. ___. 1957. K. P. Schmidt. (4):331. N

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178. ___. 1959. Myron Gordon. (2):184-185. N

179. ___. 1959. Fritz Mayer. (2):185. N

180. ___. 1959. Richard D. Miller. (2):185. N

181. ___. 1959. J. R. Pfaff. (2):185. N

182. ___. 1959. Norman B. Scofield. (2):185. N

183. ___. 1959. Moichiro Maki. (3):272. N

184. ___. 1960. Bela Hanko. (2):164. N

185. ___. 1960. Richard B. Miller. (2):164. N

186. ___. 1960. Paul S. Welch. (2):164. N

187. ___. 1960. August Thienemann. (4):391. N

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192. ___. 1961. Dr. Peter O. Okkelberg. (2):260. N

193. ___. 1961. Dr. T. C. Roughley. (2):261. N

194. ___. 1961. William M. Mann. (3):368 N

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212. ___. 1965. John Richardson Dymond. (1):124. N

213. ___. 1965. Colonel John K. Howard. (2):262. N, B

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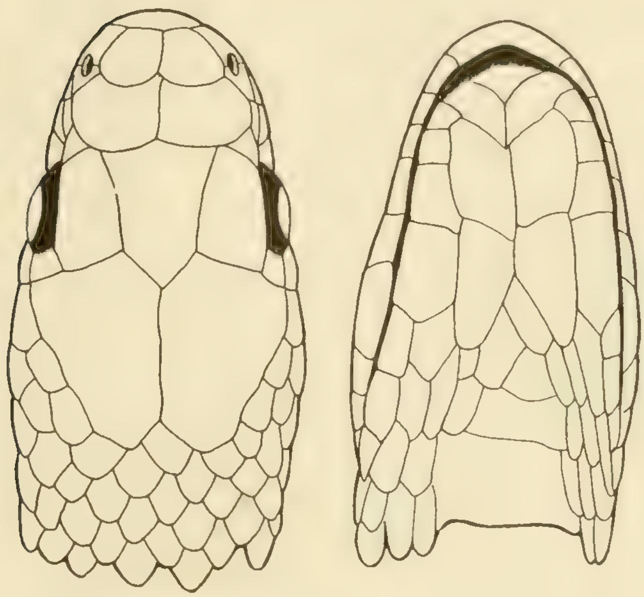
A KEY AND CHECKLIST TO THE NEOTROPICAL SNAKE GENUS LIOPHIS WITH COUNTRY LISTS AND MAPS



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INTRODUCTION

The genus *Liophis* currently contains 35 species and 62 recognized subspecies. About 137 names have been proposed, attesting to extensive qualitative and quantitative variation between and among the species of *Liophis*. The purpose of the checklist, keys, and country lists is to offer museum curators and herpetologists a means to identify the species and subspecies of one of the most commonly encountered xenodontine snake genera of the Neotropics. Species lists are constructed from specimens personally examined and verified by me. The keys resulted from an analysis of variation of 5,198 specimens of all recognized populations.

Some species have been recognized since 1758 and others as recently as 1987. Some species are represented in collections by only a few specimens (*L. atraventer*, *L. problematicus*), by several hundred (most species), or over a thousand (*L. miliaris*, *L. poecilogyrus*). Taxonomic data are generally adequate for most taxa.

The checklist contains the accepted name and its author, followed by primary synonomies, their author(s), date, page number, and type locality. The primary synonomies are followed by the author, date, and page number of the first proper usage of the epithet, if necessary for clarification. Species are arranged alphabetically. Subspecies are also arranged alphabetically under each species, except for the nominate race, which is placed first. Synonomies for subspecies follow the accepted name, arranged in alphabetical order, followed by the author(s) name(s). A statement of distribution follows the synonomy of each species and subspecies, along with a citation denoting a publication with a distribution map.

KEY TO SPECIES OF <u>LIOPHIS</u>

1.a Posterior dorsal scale rows at least two less than at midbody 5
b Dorsal scale rows without reduction 2

2.a Dorsal scale rows 15-15-15 3
b Dorsal scale rows 17-17-17 4

3.a Three supralabials entering orbit .... *andinus*
b Two supralabials entering orbit. *reginae* (=*oligolepis* of others)

4.a Eight supralabials (rarely seven); dorsum olive green with or without reddish vertebral stripe and small dorsolateral black spots .... *jaegeri*
b Seven supralabials; dorsum tan or brown with darker blotches and four blackish posterior lines, and a black edged, white labial stripe .... *williamsi*

5.a Nineteen midbody dorsal scale rows 29
b Seventeen midbody dorsal scale rows 6

6.a Dorsal scale rows 17-17-15 7
b Dorsal scale rows 17-17-13 .... *flavifrenatus*

7.a Seven supralabials 8
b Eight supralabials 9

8.a Light dorsal bands not widened laterally into broad triangles; $\leq$ 17 maxillary teeth .... *breviceps*
b Light dorsal bands distinctly widened laterally into broad triangles; $\geq$ 20 maxillary teeth .... *longiventris*

9.a Venter with checkered pattern of black and red or yellow 10
b Venter never checkered with black and red or yellow, but occasionally with black marks on lateral edges of ventrals 19

10.a Black lateral posterior stripe present and extends onto tail 11
b Not as above 13

11.a Apical scale pit present 12
b No scale pit .... *taeniurus*

12.a Posterior lateral black stripe occurs as an edge between 3rd and 4th scale rows .... *reginae*
b Posterior lateral black stripe occurs over most of 3rd, one-third to all of 4th and occasionally on 5th scale row .... *epinephelus*

13.a One preocular 14
b Two preoculars .... *festae*

14.a Ventrals $\leq$179 15
b Ventrals $\geq$186 .... *frenatus*

15.a Apical scale pit present, tail length $\geq$26% of total length 16
b Scale pit absent, tail length $\leq$23% of total length 17

16.a Subcaudals $\geq$74; $\geq$26 maxillary teeth .... *juliae*
b Subcaudals $\leq$72; $\leq$27 maxillary teeth .... *epinephelus*

17.a Banded dorsal pattern, occasionally a combination bands and reticulations; ventrals and subcaudals always checkered with black and red or yellow 18
b Salt and pepper dorsal pattern, obscure in Amazon populations; venter light with some dark edging in all populations except Amazon, where large black checkered marks are present; Amazon population usually with dusky throats and white subcaudals, subcaudals of other populations white or dark edged .... *miliaris*

18.a Light body bands widened laterally into broad triangles .... *longiventris*
b Light body bands of equal width .... *cobellus*

19.a Lateral edge of ventrals unmarked 20
b Lateral edge of ventrals marked with black 25

20.a Dorsum with or without posterior lateral black stripes; $\geq$13 maxillary teeth 21
b Dorsum with three dark lines from head to tail; $\leq$13 maxillary teeth .... *paucidens*

21.a Posterior lateral black stripe present on body and tail 22
b Stripe absent 23

22.a Nine infralabials; $\leq$21 maxillary teeth; tail length about 22% of total length .... *melanotus*
b Ten infralabials; $\geq$21 maxillary teeth; tail length about 26% of total length .... *reginae*

23.a Subcaudals $\geq$74; dorsum uniform color or variable, but never green or olive green 24
b Subcaudals $\leq$73; dorsum olive green or green, with or without reddish dorsal stripe and small dorsolateral black spots .... *jaegeri*

24.a Ventrals $\leq$167 .... *juliae*
b Ventrals $\geq$182 .... *perfuscus*

25.a Dorsum without dark stripes 26
b Dorsum with dark stripes 28

26.a Tail length ≥26% of total length 27
b Tail length ≤23% of total length .... miliaris

27.a Subcaudals ≤93 .... ornatus
b Subcaudals ≥96 .... cursor

28.a Dorsum with three dark and two yellow stripes, yellow stripes begin on snout .... flavifrenatus
b Dorsum with three to five dark stripes, yellow stripes absent .... triscalis

29.a Dorsal scale rows 19-19-17 30
b Dorsal scale rows 19-19-15 or 19-19-13 39

30.a Dorsum uniform green or olive green, occasionally with an ill-defined reddish brown mid-dorsal stripe 31
b Dorsum variable, but never uniform or with an ill-defined reddish mid-dorsal stripe 33

31.a Ventrals ≤159 32
b Ventrals ≥169 .... viridis

32.a Venter rose or red; ≥62 subcaudals; ≥25 maxillary teeth .... maryellenae
b Venter black; ≤56 subcaudals; ≤24 maxillary teeth .... atraventer

33.a One preocular 34
b Two preoculars .... festae

34.a Dorsum uniform brown or with two to five dark lines on a tan to light brown ground color 35
b Dorsum gray or olive, with or without dark irregular marks scattered throughout; or dorsum brown to dark brown with large blotches or bands anteriorly 37

35.a Dorsum tan or light brown with three to five distinct dark stripes, the median stripe beginning on the snout or the nape 36
b Dorsum uniform brown, with or without dark freckles and a dark ventrolateral line .... sagittifer

36.a Dorsum tan or light brown with three distinct black lines, the median line beginning on the snout, ≥159 ventrals; ≥77 subcaudals; tail/total length ratio (males) ≥.24 .... lineatus

b Dorsum light brown with a broad dark median stripe, narrow dark dorsolateral stripes, and dark ventrolateral stripes; median stripe begins on the nape; ventrals 133, subcaudals 36, tail/total length ratio .185 (known only from the male holotype) .... problematicus

37.a Dorsum gray or tan with darker blotches, no black dorsolateral line posteriorly; faint to moderately distinct dorsolateral light line posteriorly; dorsal surface of head gray, tan or brown with or without a whitish U,V,X, or Y mark on the parietals with exterior black edging, the mark may extend anteriorly to the internasals; with or without one apical scale pit 38

b Dorsum dark brown or chocolate brown, banded or blotched anteriorly with contrasting dorsolateral black and white lines posteriorly; no apical scale pit .... taeniurus

38.a Dorsal surface of frontal and parietals of head gray, brown, or olive, with or without a few darker flecks; no apical scale pit present (characters from type description) .... carajasensis

b Dorsal surface of frontal and parietal scales of head gray, brownish or live, with a whitish U, V, X, or Y mark with exterior black edging, mark may extend onto the internasals; one apical scale pit present .... almadensis

39.a Dorsal scale rows 19-19-15 40

b Dorsal scale rows 19-19-13 .... perfuscus

40.a Dorsum bright green; head occasionally blue, with or without dark chevrons dorsally and/or laterally 41

b Dorsum variable but never green 42

41.a Ventrals ≤168 .... typhlus

b Ventrals ≥187 .... guentheri

42.a Dorsum with black and/or yellow longitudinal stripes............ 43

b Dorsum variable but without stripes............................ 46

43.a Dorsum blotched, ground color olive or brown, with darker blotches above and below narrow yellow paravertebral lines 45

b Dorsum striped, ground color tan or light brown, with three black stripes, or three black and two yellow stripes, the median stripe beginning on the snout 44

44.a Dorsum with three dark and two narrow yellow stripes, yellow stripes and median dark stripe begin on snout .... meridionalis

b Dorsum with three wide black stripes, median black stripe begins on snout .... dilepis

45.a Ventrals $\leq$166; maxillary teeth 13-17 .... anomalus

b Ventrals $\geq$176; maxillary teeth 18-20 .... vanzolinii

46.a Dorsum uniform or variable, but never as below 47

b Dorsum tan or yellowish, with four rows of rounded black, reddish, or reddish brown spots, lateral row of spots smaller than paravertebral row ....sagittifer (see 35)

47.a Dorsum blotched or with squarish spots 48

b Dorsum uniform brown to chocolate brown .... perfuscus

48.a Head gray to black, occasionally with light or dark markings, but never red, no middorsal reddish stripe, and generally without rounded black, intercalary spots 49

b Head black, spotted with red; dorsum with large paravertebral black blotches on olive ground color, rounded lateral black intercalary spots, broad diffuse median ruddy stripe from head to tail, frequently invaded by dorsolateral black spots .... elegantissimus

49.a Ground color usually gray or tan with a broad whitish dorsolateral line from midbody to tail on scale rows 4, 5 and 6, or 5 and 6;body with small squarish blotches slightly to moderately darker than ground color; venter checkered with black and some shade of pink or red maxillary teeth 19-25 (mode 21-22); diameter of eye 56-78% ($\bar{x}$= 66%) of snout length .... Liophis sp.

b Ground color usually brown to almost black, one subspecies with an ill-defined, posterior dorsolateral whitish stripe on scale rows 5 and 6. Head usually uniform brown or black; if brown, cephalic scales edged with black; dorsal color pattern highly variable, from salt and pepper pattern to blotches, bands, reticulations or combinations of the above and in many colors; venter from immaculate white to almost black. Maxillary teeth 13-21 (mode 17-18); diameter of eye 41-66% ($\bar{x}$= 54%) per cent of snout length .... poecilogyrus

GENUS LIOPHIS Wagler, 1830:187

Liophis almadensis (Wagler)

Natrix almadensis Wagler 1824:30. Type locality: Almada, Bahia, Brasil.
Natrix almada Wagler 1824:30. (as above)
Liophis conirostris Günther 1854:46. Type locality: Brasil and Bahia.
L. (iophis) verecundus Jan 863:300. Type locality: unknown.
Liophis wagleri Jan 1863:297. Type locality: Brasil and Bahia.
Liophis (Lygophis) y-graecum Peters 1882:129. Type locality: Villa de Guaratinqueta, São Paulo (Brasil).
Trigonocephalus scolecomorphus Bacque 1906:116. Type locality: Asuncion, Paraguay.
Liophis almadensis Wagler 1830:188.

DISTRIBUTION: Chaco Boreal plant formation of Bolivia, all plant formations of Brazil except for Caatinga and Amazon rainforest; Paraguay except for cropland situations in central Paraguay. (published reports of this taxon from the state of Misiones, Argentina, have not been verified).

SUBSPECIES: none described; possibly one undescribed cryptic subspecies in Argentina and western Bolivia.

Liophis andinus Dixon

Liophis andinus Dixon 1983:129. Type locality: Incachaca, 2500 m, Cochabamba, Bolivia.

DISTRIBUTION: Known only from the type locality (Figure 2, p. 118, Dixon, 1983).

Liophis anomalus (Günther)

Coronella anomala Günther 1858:37. Type locality: banks of the Río Paraná.
Lygophis rutilis Cope 1862:80. Type locality: Río Tígre, a tributary of the Río Paraná, Paraguay.
Coronella pulchella Jan 1863:251. Type locality: Buenos Aires, Argentina.
Liophis anomala Amaral 1925:7.

DISTRIBUTION: Southern South America, from northwestern Argentina (Salta) east-southeast through Uruguay to Pôrto Alegre, Brasil, south to the province of Buenos Aires, Argentina.

Liophis atraventer Dixon and Thomas

Liophis atraventer Dixon and Thomas 1985:260. Type locality: Boracéia, São Paulo, Brasil.

DISTRIBUTION: Known only from the type locality (= Estação Biologica da Boracéia) (figure 4, p. 188, Dixon, 1987).

Liophis breviceps Cope

Liophis breviceps Cope 1860:252. Type locality: Suriname.
Liophis canaima Roze 1957:188. Type locality: Río Ugueto, Amazonas, Venezuela.

DISTRIBUTION: Eastern flanks of the Andes of Ecuador and Perú, eastward to Obidos, Brasil; on the north from central Colombia and northern Guyana south to Río Mamoré (Trinidad) Bolivia, and Posto Diuarum, Brasil.

SUBSPECIES: Two.

1.a Ventrals ≤169 .... *breviceps breviceps*
b Ventrals ≥176 .... *breviceps canaimus*

Liophis breviceps breviceps Cope 1862:252. Type locality: Suriname.

DISTRIBUTION: Forested parts of the Amazon Basin in Bolivia, Brasil, Colombia, Perú, and similar areas in French Guiana, Guyana, Suriname, and Venezuela (see figure 3, p. 154, Dixon 1983).

Liophis breviceps canaima Roze 1957:188. (see above)

DISTRIBUTION: Known only from the region of the Río Ugueto, Amazonas, Venezuela (see figure 3, p. 154, Dixon 1983).

Liophis carajasensis Cunha, Nascimento and Avila-Pires

Liophis carajasensis Cunha, Nascimento and Avila-Pires 1985:53. Type locality: Campo Rupestre d. N 1, Serra Norte, Pará, Brasil.

DISTRIBUTION: Known only from the type locality (see figure between pp. 18 & 19, Cunha, et al 1985).

Liophis cobellus (Linnaeus)

Coluber cobella Linnaeus 1758:218. Type locality: America.
Coluber serpentinus Daudin 1803:87. Type locality: none given.
Coluber cenchrus Daudin 1803:292. Type locality: Asia.
Liophis taeniogaster Jan 1863:292. Type locality: Brasil and South America.
Liophis trebbaui Roze 1958:262. Type locality: Auyán Tepuí, Bolívar, Venezuela.
Liophis ingeri Roze 1958:303. Type locality: Chimantá Tepuí, Bolivar, Venezuela.

DISTRIBUTION: From Villavicencio, Colombia, south to Buenavista, Bolivia, and from Trinidad and Carapito, Venezuela, southeast to Bahia, Brasil.

SUBSPECIES: Four.

1.a Ventrals ≥171 .... *cobellus ingeri*
b Ventrals ≤164 2

2.a Ventral black bands $\geq$45 .... cobellus cobellus
b Ventral black bands $\leq$38 3

3.a Ventrals vary from 130-147 ($\bar{x}$= 138.4) .... cobellus dyticus
b Ventrals vary from 143-164 ($\bar{x}$= 151.6) ..... cobellus taeniogaster

Liophis cobellus cobellus (Linnaeus) 1758:292.

SYNONYMS: serpentinus Daudin, cenchrus Daudin.

DISTRIBUTION: Eastern Guyana Shield, exclusive of Venezuela Tepuí system; also Trinidad (see figure 4, p. 158, Dixon 1983).

Liophis cobellus dyticus Dixon 1983:159. Type locality: Monte Carmelo (= Requena), Loreto, Perú.

DISTRIBUTION: Western Amazon Basin, from Loma Linda, Colombia, south to Buenavista, Bolivia, east to Pôrto Velho, Brasil (see figure 4, p. 158, Dixon 1983).

Liophis cobellus taeniogaster Jan 1863:292. (see above)

DISTRIBUTION: Northeast Brasil, from Isla Bananal, east to central Bahia, north to Rio Amazonas (south bank) (see figure 4, p. 158, Dixon 1983).

Liophis cobellus trebbaui Roze 1958:262.

SYNONYM: ingeri Roze.

DISTRIBUTION: Known only from the Chimantá and Auyán Tepuís, and km marker 144 of the El Dorado-Santa Elena highway, Bolívar, Venezuela (see figure 4, p. 158, Dixon 1983).

Liophis cursor (Lacépède)

Coluber cursor Lacépède 1789:96. Type locality: Martinique.
Coluber fugitivus Donndorf 1798:206. Type locality: Martinique.
Liophis putnami Cope 1862:78. Type locality: Martinique.
Liophis cursor andreoides Werner 1924:36. Type locality: Grenada.

DISTRIBUTION: Known only from the island of Martinique, West Indies (see figure 1, p. 297, Dixon 1981).

Liophis dilepis (Cope)

Lygophis dilepis Cope 1862:348. Type locality: Paraguay.
Liophis dilepis, Dixon 1980:7.

DISTRIBUTION: From northeast Brasil, south to southern Brasil, and Paraguay, extending northwest to southern Bolivia (see figure 1, p. 4, Michaud and Dixon 1987).

Liophis elegantissimus (Koslowsky)

Rhadinaea elegantissima Koslowsky 1895:115. Type locality: Sierra de la Ventana, Province of Buenos Aires, Argentina.
Liophis elegantissimus, Amaral 1925.

DISTRIBUTION: Known from five localities within the Sierra de la Ventana, Buenos Aires, Argentina (see figure 1, p. 566, Dixon 1985).

Liophis epinephelus Cope

Liophis epinephelus Cope 1862:78. Type locality: Truando, Colombia.
Liophis reginae albiventris Jan 1863:294. Type locality: Western Andes of Ecuador (fra Lacutunga e Guayaquil) (= Latacunga?).
Liophis reginae quadrilineata Jan 1863:295. Type locality: Ecuador.
Ophimorphus alticolus Cope 1868:102. Type locality: Quito Valley, Ecuador.
Zamensis ater Günther 1872:22. Type locality: Biscra, Algeria (in error).
Liophis fraseri Boulenger 1894:131. Type locality: Western Ecuador.
Liophis bimaculatus Cope 1899:71. Type locality: Colombia.
Liophis bipraeocularis Boulenger 1903:351. Type locality: Facatativa, Colombia.
Liophis opisthotaenia Boulenger 1908:114. Type locality: Mérida, Venezuela.
Liophis pseudocobella Peracca 1914:99. Type locality: Angelópolis, Colombia.
Liophis cobella alticolus Amaral 1931:87. Type locality: Jericó, Colombia.
Liophis taeniurus juvenalis Dunn 1937:213. Type locality: San Jose, Costa Rica.
Liophis bimaculatus lamonae Dunn 1944:486. Type locality: Sonsón, Antioquia, Colombia.
Liophis epinephelus ecuadorensis Laurent 1949:8. Type locality: Ecuador.

DISTRIBUTION: Trans-Andean South America from Venezuela to Perú; Cis-Andean South America at and above 2,200 m in Ecuador and Perú; also Central America from central Costa Rica through Panamá (see figures 1, 2, and 3, pp. 133-135, Dixon 1983).

SUBSPECIES: Eight.

1.a Lateral black tail stripe absent, dorsal and ventral surfaces of body and tail alternately marked with red and black 2
b Lateral black tail stripe present, dorsum may be banded, spotted, flecked, or almost unicolor, belly checkered with black or not 3

2.a Subcaudals ≤ 54 .... *epinephelus pseudocobellus*
b Subcaudals ≥ 54 .... *epinephelus juvenalis*

3.a Ventrals ≤ 165 4
b Ventrals ≥ 165 .... *epinephelus bimaculatus*

4.a Anterior half of dorsum with or without black flecks, streaks, or dark spots, never banded in adults; ventrals $\geq$143 5
b Anterior fourth of dorsum banded with black or brownish black bands, venter immaculate white, yellow or reddish; ventrals $\leq$143 .... _epinephelus epinephelus_

5.a Venter immaculate white, yellow or pinkish 6
b Venter checkered with marks of yellow and black 7

6.a Dorsum leaf green with flecks of black, posterior dorsolateral black stripe usually absent .... _epinephelus albiventris_
b Dorsum olive, olive brown, or grayish brown, posterior dorsolateral black stripe usually present .... _epinephelus opisthotaenius_

7.a Ventrals from 141-156 ($\bar{x}$= 150), subcaudals from 51-67 ($\bar{x}$= 59) .... _epinephelus lamonae_
b Ventrals from 151-164 ($\bar{x}$= 157), subcaudals from 61-76 ($\bar{x}$= 67)............................ _epinephelus fraseri_

Liophis epinephelus epinephelus Cope 1862.

DISTRIBUTION: Lower elevations of the mountains of western Panamá, east to Colombian lowlands, most interAndean valleys below 1,500 m, extending southward along the Colombian coast to northern Ecuador (see figures 1-3, pp. 133-135, Dixon 1983).

Liophis epinephelus albiventris Jan 1863.

SYNONYMS: _alticolus_ Cope, _ater_ Günther, _quadrilineatus_ Jan

DISTRIBUTION: Western Ecuador from sealevel to 2,600 m elevation (see figure 3, p. 153, Dixon 1983).

Liophis epinephelus bimaculatus Cope 1899.

SYNONYMS: _bipraeocularis_ Boulenger, _ecuadorensis_ Laurent

DISTRIBUTION: High Andean slopes (2,600 - 3,300 m) of western Venezuela, central Colombia, south to northern Perú (see figures 2, 3, p. 134, 135, Dixon 1983).

Liophis epinephelus fraseri Boulenger 1894.

DISTRIBUTION: Middle elevations of the eastern and western slopes of southern Ecuador, south to central Perú (see figure 4, p. 136, Dixon 1983).

Liophis epinephelus juvenalis Dunn 1937.

DISTRIBUTION: Middle slopes of mountains from central Costa Rica to western Panamá (see figure 1, p. 133, Dixon 1983).

Liophis epinephelus lamonae Dunn 1944.

DISTRIBUTION: Andean slopes (1,500 - 2,600 m) of Colombia, southward to east-central Ecuador (see figures 2, 3, pp. 134, 135, Dixon 1983).

Liophis epinephelus opisthotaenius Boulenger 1908.

DISTRIBUTION: Mérida region of Venezuela and the Páramo de Tama region of Venezuela and Colombia (see figure 2, p. 134, Dixon 1983).

Liophis epinephelus pseudocobellus Peracca 1914.

SYNONYM: alticolus Amaral.

DISTRIBUTION: Middle elevations of central and western Andes of Colombia, south to Ecuador border (see figure 2, p. 134, Dixon 1983).

Liophis festae (Perraca)

Rhadinaea festae Peracca 1897:16. Type locality: Valley of Río Santiago, Ecuador.
Liophis festae, Amaral 1929:171.

DISTRIBUTION: From middle elevations of southern Colombia, south through Ecuador, to the middle elevations of Cis-Andean central Perú.

Liophis flavifrenatus (Cope)

Lygophis flavifrenatus Cope 1862:80. Type locality: Río Vermejo, (Bermejo region) Paraguay.
Dromicus amabilis Jan 1867: livr. 24. Type locality: Brasil.
Liophis flavifrenatus, Dixon 1980:8.

DISTRIBUTION: Southern Brasil, southward through central and southern Paraguay, northeastern Argentina, and extreme southeastern Brasil (see figure 3, p. 9, Michaud and Dixon 1987).

Liophis frenatus (Werner)

Rhadinaea frenata Werner 1909:224. Type locality: Paraguay.
Rhadinaea brazili Amaral 1923:87. Type locality: Julio Pontes, Brasil.
Liophis frenatus, Amaral 1929:45.

DISTRIBUTION: From Primavera, Paraguay, east-southeast to Guayuvira, Brasil (see figure 2, p. 154, Dixon 1983).

Liophis guentheri Peracca

Liophis guentheri Peracca 1897:11. Type locality: Caiza, Bolivia.

DISTRIBUTION: Apparently restricted to the central Chaco region of Argentina, Bolivia and Paraguay (see figure 1, p. 175, Dixon 1987).

Liophis jaegeri (Günther)

Coronella jaegeri Günther 1858:37. Type locality: Brasil.
Liophis dorsalis Peters 1863:283. Type locality: Brasil.
Aporophis coralliventris Boulenger 1894:346. Type locality: an island north of Concepcion, near San Salvador, north Paraguay.
Rhadinaea lineata Jensen 1900:105. Type locality: Taboleiro Grande, Minas Gerais, Brasil.
Liophis jaegeri, Amaral 1926:78.

DISTRIBUTION: Southeast Brasil to coastal Uruguay, and the Río Paraná Basin of Argentina, Brasil, and Paraguay (see figure 3, p. 184, Dixon 1987).

SUBSPECIES: Two.

1.a Subcaudals from 63-75 ($\bar{x}$= 68.5); tail/total length ratios from 0.214-0.268 ($\bar{x}$= 0.231) .... jaegeri coralliventris
b Subcaudals from 52-71 ($\bar{x}$= 60.4); tail/total length ratios from 0.193-0.248 ($\bar{x}$= 0.221) .... jaegeri jaegeri

Liophis jaegeri jaegeri (Günther) 1858.

SYNONYMS: dorsalis Peters, lineata Jensen.

DISTRIBUTION: Southeastern Brasil and coastal Uruguay, east of the Río Paraná Basin (see figure 3, p. 184, Dixon 1987).

Liophis jaegeri coralliventris (Boulenger) 1894 (see above)

DISTRIBUTION: Known only from the Río Paraná Basin of Argentina, Brasil, and Paraguay (see figure 3, p. 184, Dixon 1987).

Liophis juliae (Cope)

Aporophis juliae Cope 1879:373. Type locality: Dominica.
Leimadophis mariae Barbour 1914:340. Type locality: Marie-Galante
Dromicus juliae copeae Parker 1936:232. Type locality: Guadeloupe
Liophis juliae, Dixon 1980:10.

DISTRIBUTION: West Indian islands of Dominica, Guadeloupe, and Marie-Galante.

SUBSPECIES: None recognized.

Liophis lineatus (Linnaeus)

Coluber lineatus Linnaeus 1758:221. Type locality: Asia (in error)
Coluber jaculatrix Linnaeus 1766:381. Type locality: Suriname
Coluber terlineatus Lacépède 1826:106. Type locality: none given.
Liophis lineatus, Dixon 1980:10.

SUBSPECIES: None recognized.

DISTRIBUTION: Central Panamá east through Colombia, Venezuela, Guyana, Suriname, French Guiana, to the mouth of the Rio Amazonas, Brasil (Figure 1, p. 4, Michaud and Dixon 1987). A few specimens are known from near the port cities of Guayaquil and Esmeraldas, Ecuador, and are probably accidental introductions via the shipping trade.

Liophis longiventris Amaral

Liophis longiventris Amaral 1925:16. Type locality: none given, but probably the state of Mato Grosso, Brasil.

DISTRIBUTION: Known only from Rio Manjuro, Amazonas, Brasil, and from 12°51'S - 51°46'W, Mato Grosso, Brasil (see figure 2, p. 154, Dixon 1983).

Liophis maryellenae Dixon

Liophis maryellenae Dixon 1985:295. Type locality: Annapolis, Goiás, Brasil.

DISTRIBUTION: Central, southeast Brasil, from Annapolis on the west, to Grão Mogol, on the east; from near Barreiras on the north, to Itambe do Dentro on the south (see figure 4, p. 188, Dixon 1987).

Liophis melanotus (Shaw)

Coluber melanotus Shaw 1802:534. Type locality: Cape of Good Hope, Africa (in error).
Coluber raninus Merrem 1820:106. Type locality: none given.
Coluber vittatus Hallowell 1845:242. Type locality: within 200 miles of Caracas, Colombia (actually in Venezuela).
Liophis melanonotus Cope 1860:253. (replacement name for *melanotus* Shaw).
Liophis melanotus, Dixon 1980:11.

DISTRIBUTION: From both sides of the Andes in Central Colombia, northeast to northeastern Venezuela, Trinidad and Tobago.

SUBSPECIES: Possibly one, undescribed.

1.a Dorsolateral black stripe begins on the nape and is continuous to the tail, head more or less uniform in color, without distinct white parietal spots, maxillary teeth vary from 14-17 ($\bar{x}$= 15.3) .... melanotus (subsp.)

b Dorsolateral black stripe begins posterior to nape, interrupted anteriorly by nape bands or spots that are separated by light colored interspaces, parietals with white diagonal marks extending to the posterior corner of mouth, maxillary teeth vary from 14-21 ($\bar{x}$= 17.9) .... melanotus melanotus

Liophis meridionalis (Schenkel)

Aporophis lineatus meridionalis Schenkel 1901:160. Type locality: Mte. Sociedad, Bemalcue, Paraguay.
Aporophis lineatus lativittatus Mueller 1908:74. Type locality: San Fermin (Chiquitos), Bolivia.
Liophis meridionalis, Dixon 1980:11.

DISTRIBUTION: Central Brasil and northern Bolivia south to southern Paraguay, northeastern tip of Argentina, and extreme southeastern Brasil. (figure e, p. 9, Michaud and Dixon, 1987).

Liophis miliaris (Linnaeus)

Coluber miliaris Linnaeus 1758:220. Type locality: India (in error).
Coluber merremii Wied 1821:121. Type locality: Pedro d'Alcantara, Bahia, Brasil.
C. (oluber) dictyodes Wied 1824:668. Type locality: Cabo Frio, Rio de Janeiro, Brasil.
Coluber bicolor Reuss 1834:145. Type locality: Ilheus, Bahia, Brasil.
Ablabes purpurans Dumeril, Bibron and Dumeril 1854:312. Type locality: Mana, Cayenne. (French Guiana)
Coronella australis Günther 1858:40. Type locality: Australia (in error).
Opheomorphus merremii semiaureus Cope 1862:348. Type locality: Paraguay.
Liophis cobella collaris Jan 1863:293. Type locality: South America.
Liophis reginae ornata Jan 1863:295. Type locality: Buenos Aires, Argentina.
Coronella orientalis Günther 1864:236. Type locality: Dekkan (in error).
Rhadinaea chrysostoma Cope 1868:104. Type locality: Napo or Marañon, Ecuador (= Perú).
Coronella poecilolaemus Günther 1872:19. Type locality: Upper Río Amazonas.
Opheomorphus fuscus Cope 1885:190. Type locality: São João da Monte Negro, Rio Grande do Sul, Brasil.
Rhadinaea orina Griffin 1916:195. Type locality: Sierras of Bolivia (in error).
Dromicus amazonicus Dunn 1922:219. Type locality: Santarém, Brasil.
Rhadinaea merremii natricodes Werner 1926:246. Type locality: unknown.
Liophis mossoroensis Hoge and Lima-Verde 1972:215. Type locality: Mossoro, Rio Grande do Norte, Brasil.
Liophis miliaris, Amaral 1926:78.

DISTRIBUTION: Eastern South America, from Guyana south to Buenos Aires, Argentina, with scattered records in the Amazon Basin and Cerrado of Brasil (see figure 1, p. 792, Dixon 1983; figures 5, 6, and 7, pp. 12-14, Gans 1964).

SUBSPECIES: Seven.

1.a Venter with large medial, contrasting yellow and black marks from near throat to the anal plate .... _miliaris_ _chrysostomus_
b Venter without checkerboard pattern of yellow and black marks, but ventrals may be edged or have a suffusion of dark color 2

2.a Ventrals from 163-190 ($\bar{x}$= 176.2); dorsum typically with dark blotches with light interspaces .... _miliaris_ _semiaureus_
b Ventrals $\leq$173; dorsum typically unicolored or with light centers to each scale, or with dorsal and lateral dark blotches separated by dorsolateral light lines posteriorly, or with an almost black dorsum with light flecks scattered throughout 3

3.a Subcaudals $\geq$76 or more, juveniles with a pair of light nuchal spots, adults uniform brown, each dorsal scale with a pale light center .... _miliaris_ _amazonicus_
b Subcaudals $\leq$68; juvenile pattern variable, but never with a pair of light nuchal spots, adults light tan to black, with light centered scales, or with light flecks scattered throughout 4

4.a Dorsum light to dark brown, each scale with a light center, venter obscurely marked with dark or each ventral lightly edged with black 5
b Dorsum dark brown to black with scattered flecks of white, or with both dorsal and lateral dark blotches separated posteriorly by a dorsolateral light line; venter uniform white, or marked with black 6

5.a Juveniles with dark-edged gulars; venter marked with yellow and black. Adults with or without obscure marks on the gulars; dorsum dark brown with obscure light centers to each scale; venter with less contrasting dark and light marks .... _miliaris_ _miliaris_
5.b Juveniles with white gulars; venter white or ventrals edged with black laterally. Adults with white venters, but each ventral lightly edged with black laterally and black color eventually meeting at the midline posteriorly; dorsum of adults brown to dark brown with highly contrasting light centers to each scale .... _miliaris_ _orinus_

6.a Ventrals from 148-166 ($\bar{x}$= 158.7); dorsum dark brown to black with many scattered white flecks; edges of ventrals and subcaudals heavily marked with black from midbody to the tip of the tail .... miliaris mossoroensis

b Ventrals from 135-156 ($\bar{x}$= 146.5); dorsum with a series of dark brown to black dorsal and lateral blotches on a light tan, greenish or brown ground color, with a dorsolateral light line separating the dorsal and lateral blotches posteriorly. Occasionally, the dorsum is uniform in color with a light center to each scale; ventrals and subcaudals immaculate white or cream .... miliaris merremii

Liophis miliaris miliaris (Linnaeus) 1758.

SYNONYMS: purpurans Dumeril, Bibron and Dumeril; orientalis Günther; collaris Jan.

DISTRIBUTION: Guyana, Suriname, and French Guiana (see figure 1, p. 792, Dixon 1983).

Liophis miliaris amazonicus (Dunn) 1922.

DISTRIBUTION: Santarém, Brasil, south to Rio Iténez, Beni, Bolivia, east and south to Mato Grosso, Brasil (see figure 1, p. 792, Dixon 1983).

Liophis miliaris chrysostomus (Cope) 1868.

SYNONYM: poecilolaemus Günther.

DISTRIBUTION: Rainforests of Brasil, Colombia, Ecuador and Perú (see figure 1, p. 792, Dixon 1983).

Liophis miliaris merremii (Wied) 1821.

SYNONYMS: australis Günther; bicolor Reuss; dictyodes Wied.

DISTRIBUTION: Recife, Pernambuco, Brasil, south-southwest to Rio de Janeiro (principally the Brasilian Atlantic rainforest).

Liophis miliaris mossoroensis Hoge and Lima-Verge 1972.

DISTRIBUTION: Northeastern Brasil, primarily Caatinga and dry Cerrado (see figure 1, p. 792, Dixon 1983).

Liophis miliaris orinus (Griffin) 1914.

SYNONYM: natricoides Werner.

DISTRIBUTION: Southeastern Brasil, from southern Minas Gerais, south through the states of São Paulo, Paraná, Santa Catarina, to the northern one-third of Rio Grande do Sul (see figure 1, p. 792, Dixon 1983).

Liophis miliaris semiaureus (Cope) 1862.

SYNONYMS: fuscus Cope; ornata Jan.

DISTRIBUTION: Paraguay, west and south of Iguazú Falls; northeastern Argentina; southern and eastern Uruguay; southern one-half of the Brasilian state of Rio Grande do Sul (see figure 1, p. 792, Dixon 1983).

Liophis ornatus (Garman)

Dromicus ornatus Garman 1887:281. Type locality: Saint Lucia, West Indies.
Dromicus giganteus Jan 1863:67. Type locality: unknown (see Dixon, 1981, concerning the nature of this senior synonym).
Leimadophis boulengeri Barbour 1914:339 (replacement name for ornatus Garman)
Liophis ornatus, Dixon 1981:13.

DISTRIBUTION: Saint Lucia and the satellite island of Maria (see figure 1, p. 792, Dixon 1983).

Liophis paucidens (Hoge)

Lygophis paucidens Hoge 1953:253. Type locality: Mato Verde, Mato Grosso, Brasil.
Liophis paucidens, Dixon 1980:13.

DISTRIBUTION: Known only from east-central Brasil (see figure 3, p. 9, Michaud and Dixon 1987).

Liophis perfuscus Cope

Liophis perfuscus Cope 1862:77. Type locality: Barbados.
Liophis rufus Jan 1863:91. Type locality: unknown.

DISTRIBUTION: Known only from the West Indian island of Barbados (see figure 1, p. 297, Dixon 1981).

Liophis poecilogyrus (Wied)

Coluber poecilogyrus Wied 1825:371. Type locality: Barra de Jucú, Rio Espirito Santo, Brasil.
Coluber m-nigrum Raddi 1820:338. Type locality: Rio de Janeiro, Brasil.
Natrix G. forsteri Wagler 1824:16. Type locality: Bahia, Brasil.
Coluber doliatus Wied 1825:368. Type locality: Barra de Jucú, Rio Espirito Santo, Brasil.
X. (enodon) schotti Schlegel 1837:91. Type locality: South America.
Liophis merremii sublineatus Cope 1860:252. Type locality: Buenos Aires, Argentina.
Opheomorphus doliatus caesius Cope 1862:348. Type locality: Santa Fé, Paraguay.
Liophis subfasciatus Cope 1862:77. Type locality: Paraguay.
Liophis ornatissima Jan 1863:53. Type locality: Paraná (Brasil?).
Liophis typhlus gastrostictus Jan 1863:53. Type locality: Fernambuco (= Pernambuco, Brasil).

Liophis reginae viridicyanea Jan and Sordelli 1866:18(2)91). Type locality: Paraná, Brasil.
Liophis cobella flaviventris Jan and Sordelli 1866:16(5)92). Type locality: South America.
Rhadinaea dichroa Werner 1899:115. Type locality: Argentina.
Rhadinaea praeornata Werner 1909:58. Type locality: central Brasil.
Leimadophis poecilogyrus reticulatus Parker 1931:285. Type locality: Makthlawaiya, Paraguay.
Leimadophis poecilogyrus albadspersus Amaral 1944:78. Type locality: Piracicaba, São Paulo, Brasil.
Leimadophis poecilogyrus amazonicus Amaral 1944:81. Type locality: probably Pará, Brasil (but not stated as such).
Leimadophis poecilogyrus franciscanus Amaral 1944:80. Type locality: Pirapora, Minas Gerais, Brasil.
Leimadophis poecilogyrus intermedius Amaral 1944:81. Type locality: Goiás, Brasil.
Leimadophis poecilogyrus montanus Amaral 1944:79. Type locality: Piquete, São Paulo, Brasil.
Leimadophis poecilogyrus pictostriatus Amaral 1944:77. Type locality: Sao Lourenço, Brasil.
Leimadophis poecilogyrus pinetincola Amaral 1944:78. Type locality: central Paraná, Brasil.
Leimadophis poecilogyrus platensis Amaral 1944:77. Type locality: La Plata, Argentina.
Leimadophis poecilogyrus xerophilus Amaral 1944:81. Type locality: probably Ceara, Brasil (but not stated as such).
Leimadophis poecilogyrus lancinii Hoge, Romano and Cordeiro 1978:77. (replacement name for L. p. amazonicus Amaral).
Liophis poecilogyrus, Dixon 1980:13.

DISTRIBUTION: Much of eastern South America, from Venezuela (?) east and south through Brasil to central Bolivia, southeast into northeastern Argentina.

SUBSPECIES: None to possibly nine. I do not recognize subspecies of this taxon because of the mosaic nature of the variation examined thus far. Note that there are three senior synonyms for the name poecilogyrus. Any use of a senior synonym would upset the stability of the long, continued use of poecilogyrus in the literature, and I recommend none be used.

Liophis problematicus Myers

Liophis problematicus Myers 1986:2. Type locality: San Juan, Río Tambopata; Sandia Province, 14°13'S - 69°10'W, 1,520 m, Puno, Perú.

DISTRIBUTION: Known only from type locality.

Liophis reginae (Linnaeus)

Coluber reginae Linnaeus 1758:219. Type locality: India (in error).
Coluber violaceus Lacépède 1789:116. Type locality: none given.
Coluber graphicus Shaw 1802:474. Type locality: America.
Natrix semilineata Wagler 1824:33. Type locality: Rio Solimöes, Brasil.

<u>Liophis</u> <u>oligolepis</u> Boulenger 1905:455. Type locality: Igapé-Assu, Pará, Brasil.
<u>Leimadophis</u> <u>reginae</u> <u>macrosoma</u> Amaral 1935:238. Type locality: Canna Brava, Goiás, Brasil.
<u>Leimadophis</u> <u>reginae</u> <u>maculicauda</u> Hoge 1954:241. Type locality: none given.
<u>Leimadophis</u> <u>zweifeli</u> Roze 1959. Type locality: Rancho Grande, Aragua, Venezuela.
<u>Liophis</u> <u>reginae</u>, Dixon 1980:24.

DISTRIBUTION: Cis-Andean South America, from Colombia to northern Argentina; also Trinidad and Tobago (see figure 2, p. 118, Dixon 1983).

SUBSPECIES: Four.

1.a Dorsum with small black and yellow spots; black lateral caudal stripe faint or absent 2
b Dorsum greenish, olive, or grayish, never with small yellow and black spots; black lateral caudal stripe always present and distinct 3

2.a Subcaudals average 80 (69-88) .... <u>reginae</u> <u>zweifeli</u>
b Subcaudals average 65 (55-78) .... <u>reginae</u> <u>semilineatus</u>

3.a Dorsal scale rows one and two pale colored,in contrast to dorsal coloration 4
b Dorsal scale rows one and two similar in color to rest of body 5

4.a Dorsum with dense pale and dark paravertebral flecking; subcaudals average 74 (63-80) .... <u>reginae</u> <u>reginae</u>
b Dorsum without pale and dark paravertebral flecking; subcaudals average 67 (63-80) .... <u>reginae</u> <u>semilineatus</u>

5.a Subcaudals with ventrolateral black spots, flecks, or smudges; subcaudals average 81 (75-91) .... <u>reginae</u> <u>macrosomus</u>
b Subcaudals immaculate; subcaudals average 70 (55-81) .... <u>reginae</u> <u>semilineatus</u>

<u>Liophis</u> <u>reginae</u> <u>reginae</u> (Linnaeus) 1758.

SYNONYMS: <u>violaceus</u> Lacépède; <u>graphicus</u> Shaw.

DISTRIBUTION: Guyana, Suriname, and French Guiana (see figure 2, p. 118, Dixon 1983).

<u>Liophis</u> <u>reginae</u> <u>macrosomus</u> (Amaral) 1935.

SYNONYM: <u>maculicaudus</u> Hoge.

DISTRIBUTION: Chaco and Cerrado of Argentina, Bolivia, Brasil, and Paraguay (see figure 2, p. 118, Dixon 1983).

Liophis reginae semilineatus (Wagler) 1824.

SYNONYM: *oligolepis* Boulenger.

DISTRIBUTION: Forested Amazon Basin of Venezuela, Colombia, Ecuador, Perú, Bolivia, and Brasil; also Atlantic rainforest of Brasil (see figure 2, p. 118, Dixon 1983).

Liophis reginae zweifeli (Roze) 1959.

DISTRIBUTION: Montane rainforests of Venezuela and Trinidad (see figure 2, p. 118, Dixon 1983).

Liophis sagittifer (Jan)

L. (*iopeltis*) *sagittifer* Jan 1863:82. Type locality: Mendoza, Argentina.
Liophis pulcher Steindachner 1867:267. Type locality: Chile (in error).
Rhadinaea modesta Koslowsky 1896:453. Type locality: Salta, Argentina.
Liophis trifasciatus Werner 1899:114. Type locality: Paraguay.
Zamensis argentinus Bréthès 1917:93. Type locality: La Banda, Santiago del Estero, Argentina.
Liophis sagittifer, Dixon 1980:15.

DISTRIBUTION: Foothills of the Andes of Bolivia and Argentina, south to Chubut, Argentina, north and east into the Monte and Chaco of Argentina and Paraguay. (see figure 2, p. 391, Dixon and Thomas 1982).

SUBSPECIES: Two.

1.a Dorsum uniform brownish gray, olive gray, or with obscure undulating middorsal dark line and some indication of a lateral dark line bordering the upper edge of scale row three; 81% of population with 19-19-17 scale rows .... *sagittifer modestus*
b Dorsum with large to median sized paravertebral reddish black to black blotches from nape to tail; often with secondary row of intercalary black blotches laterally, and occasionally a median series of dorsal blotches anteriorly; 100% of population with 19-19-15 scale rows .... *sagittifer sagittifer*

Liophis sagittifer sagittifer (Jan) 1863.

SYNONYMS: *pulcher* Steindachner; *argentinus* Bréthès.

DISTRIBUTION: Monte of Patagonia, from Tucuman, south to the state of Chubut, Argentina. (see figure 2, p. 391, Dixon and Thomas 1982).

Liophis sagittifer modestus (Koslowsky) 1896.

SYNONYM: *trifasciatus* Werner.

DISTRIBUTION: Chaco-Bonariesian Plain of Argentina, Bolivia, and Paraguay. (see figure 2, p. 391, Dixon and Thomas 1982).

Liophis taeniurus Tschudi

Liophis taeniurus Tschudi 1845:164. Type locality: Perú, in der heissen waldregion.

DISTRIBUTION: Middle and upper elevations of the Andes in southern Ecuador, south through Perú to the Cochabamba region of Bolivia.

SUBSPECIES: None described; possibly two or more suggested from recent analysis of data from additional material.

Liophis triscalis (Linnaeus)

Coluber triscalis Linnaeus 1758:224. Type locality: India (in error).
Coluber corallinus Linnaeus 1758:223. Type locality: Asia (in error).
Liophis triscalis, Boulenger 1894:129.

DISTRIBUTION: Known only from the Leeward Island of Curaçao. (see figure 1, p. 297, Dixon 1981).

Liophis typhlus (Linnaeus)

Coluber typhlus Linnaeus 1758:218. Type locality: India (in error).
Xenodon isolepis Cope 1870:155. Type locality: Pebas, Ecuador (= Perú)
Opheomorphus brachyurus Cope 1887:57. Type locality: Chupada, Mato Grosso, Brasil.
Liophis elaeoides Griffin 1916:187. Type locality: Prov. del Sara, Bolivia.
Liophis macrops Werner 1925:57. Type locality: Paramaribo, Suriname.
Liophis typhlus, Dixon 1980:16.

DISTRIBUTION: Rainforests of the Guiana Shield and Amazon Basin, also the Chaco and Cerrado of Bolivia, Brasil, and Paraguay. (see figure 1, p. 175, Dixon 1987).

SUBSPECIES: Three.

1.a Ventrals 133-163 ($\bar{x}$= 147.3); juveniles and adults with dark paravertebral chevron marks .... typhlus typhlus
b Ventrals 158-172 ($\bar{x}$= 163.5); juveniles and adults without dark chevron marks 2

2.a Subcaudals 40-49 ($\bar{x}$= 44.4); tail/total length ratios 0.140-0.160 ($\bar{x}$= 0.149) .... typhlus brachyurus
b Subcaudals 49-56 ($\bar{x}$= 52.0); tail/total length ratios 0.160-0.200 (m= 0.171) .... typhlus elaeoides

Liophis typhlus typhlus (Linnaeus) 1758.

SYNONYMS: isolepis Cope; macrops Werner.

DISTRIBUTION: Rainforests of Guiana Shield, and Amazon Basin (see figure 1, p. 175, Dixon 1987).

Liophis typhlus brachyurus (Cope) 1887.

DISTRIBUTION: Deciduous mesophytic forests of southeastern Brasil, and the Campo Cerrado forests of east-central Brasil (see figure 1, p. 175, Dixon 1987).

Liophis typhlus elaeoides Griffin 1916.

DISTRIBUTION: Mesic Chaco forests of southeastern Bolivia; northern Paraguay, and western Mato Grosso, Brasil (see figure 1, p. 175, Dixon 1987).

Liophis vanzolinii Dixon

Liophis vanzolinii Dixon 1985:567. Type locality: Achiras, Cordoba, Argentina.

DISTRIBUTION: Known only from three localities in the western part of the Argentine state of Cordoba (see figure 1, p. 566, Dixon 1985).

Liophis viridis Günther

Liophis viridis Günther 1862:58. Type locality: Pernambuco, Brasil
Liophis typhlus prasina Jan and Sordelli 1866:18(4)(3). Type locality: Brasil.

DISTRIBUTION: The Caatinga, Agreste, and Atlantic rainforests of Brasil. (see figure 2, p. 181, Dixon 1987).

SUBSPECIES: Two.

1.a Ventrals 169-188 ($\bar{x}$= 177); reduction site ventrals 98-116 ($\bar{x}$= 106.6) .... viridis viridis
b Ventrals 181-202 ($\bar{x}$= 189.8); reduction site ventrals 102-123 ($\bar{x}$= 114.6) .... viridis prasinus

Liophis viridis viridis Günther 1862.

DISTRIBUTION: The agreste and Atlantic rainforests of Brasil, from Recife to Salvador (see figure 2, p. 181, Dixon 1987).

Liophis viridis praesinus Jan and Sordelli 1866.

DISTRIBUTION: The Caatinga forest of Brasil (see figure 2, p. 181, Dixon 1987).

Liophis williamsi (Roze)

Urotheca williamsi Roze 1958:1. Type locality: El Junquito, D.F., Venezuela.
Liophis williamsi, Dixon 1980:17.

DISTRIBUTION: Cloud Forests of the coastal Andes of Venezuela (see figure 2, p. 118, Dixon 1983).

COUNTRY LISTS

(containing taxa of *Liophis*)

CENTRAL AMERICA

COSTA RICA

Liophis epinephelus juvenalis

PANAMÁ

Liophis epinephelus juvenalis
Liophis epinephelus epinephelus
Liophis lineatus

SOUTH AMERICA

ARGENTINA

Liophis sp. nov.
Liophis anomalus
Liophis elegantissimus
Liophis flavifrenatus
Liophis guentheri
Liophis jaegeri coralliventris
Liophis miliaris semiaureus
Liophis meridionalis
Liophis poecilogyrus
Liophis reginae macrosomus
Liophis sagittifer modestus
Liophis sagittifer sagittifer
Liophis vanzolinii

BOLIVIA

Liophis almadensis sub-sp.
Liophis almadensis almadensis
Liophis andinus
Liophis breviceps breviceps
Liophis cobella dyticus
Liophis dilepis
Liophis guentheri
Liophis meridionalis
Liophis miliaris amazonicus
Liophis poecilogyrus
Liophis reginae macrosomus
Liophis reginae semilineatus
Liophis sagittifer modestus
Liophis taeniurus
Liophis typhlus elaeoides
Liophis typhlus typhlus

BRASIL

Liophis atraventer
Liophis almadensis
Liophis anomalus
Liophis breviceps breviceps
Liophis carajasensis
Liophis cobellus dyticus
Liophis cobellus taeniogaster
Liophis dilepis
Liophis flavifrenatus
Liophis frenatus
Liophis jaegeri jaegeri
Liophis jaegeri coralliventris
Liophis lineatus
Liophis longiventris
Liophis maryellenae
Liophis meridionalis
Liophis miliaris amazonicus
Liophis miliaris chrysostomus
Liophis miliaris merremii
Liophis miliaris mossoroensis
Liophis miliaris orinus
Liophis miliaris semiaureus
Liophis paucidens
Liophis poecilogyrus
Liophis reginae macrosomus
Liophis reginae semilineatus
Liophis typhlus brachyurus
Liophis typhlus elaeoides
Liophis typhlus typhlus
Liophis viridis prasinus
Liophis viridis viridis

COLOMBIA

Liophis breviceps breviceps
Liophis cobellus dyticus
Liophis epinephelus bimaculatus
Liophis epinephelus epinephelus
Liophis epinephelus lamonae
Liophis epinephelus opisthotaenius
Liophis epinephelus pseudocobellus
Liophis festae
Liophis lineatus
Liophis melanotus melanotus
Liophis miliaris chrysostomus
Liophis reginae semilineatus
Liophis typhlus typhlus

ECUADOR

Liophis breviceps breviceps
Liophis cobellus dyticus
Liophis epinephelus albiventris
Liophis epinephelus bimaculatus
Liophis epinephelus epinephelus
Liophis epinephelus fraseri
Liophis epinephelus lamonae
Liophis festae
Liophis lineatus
Liophis miliaris chrysostomus
Liophis reginae semilineatus
Liophis taeniurus
Liophis typhlus typhlus

FRENCH GUIANA

Liophis breviceps breviceps
Liophis cobellus cobellus
Liophis lineatus
Liophis miliaris miliaris
Liophis poecilogyrus
Liophis reginae reginae
Liophis typhlus typhlus

GUYANA

Liophis breviceps breviceps
Liophis cobellus cobellus
Liophis lineatus
Liophis miliaris miliaris
Liophis poecilogyrus
Liophis reginae reginae
Liophis typhlus typhlus

PARAGUAY

Liophis almadensis
Liophis dilepis
Liophis flavifrenatus
Liophis frenatus
Liophis guentheri
Liophis jaegeri coralliventris
Liophis longiventris
Liophis meridionalis
Liophis miliaris semiaureus
Liophis poecilogyrus
Liophis reginae macrosomus
Liophis sagittifer modestus
Liophis typhlus elaeoides

PERÚ

Liophis breviceps breviceps
Liophis cobellus dyticus
Liophis epinephelus fraseri
Liophis festae
Liophis miliaris chrysostomus
Liophis problematicus
Liophis miliaris chrysostomus
Liophis reginae semilineatus
Liophis taeniurus
Liophis typhlus typhlus

SURINAME

Liophis breviceps breviceps
Liophis cobellus cobellus
Liophis lineatus
Liophis miliaris miliaris
Liophis poecilogyrus
Liophis reginae reginae
Liophis typhlus typhlus

URUGUAY

Liophis anomalus
Liophis jaegeri jaegeri
Liophis miliaris semiaureus
Liophis poecilogyrus

VENEZUELA

Liophis breviceps breviceps
Liophis breviceps canaimus
Liophis cobellus cobellus
Liophis cobellus trebbaui
Liophis epinephelus opisthotaenius
Liophis lineatus
Liophis melanotus melanotus
Liophis melanotus subspecies
Liophis poecilogyrus (?)
Liophis reginae semilineatus
Liophis reginae zweifeli
Liophis typhlus typhlus
Liophis williamsi

CARIBBEAN ISLANDS

BARBADOS

Liophis perfuscus

CARIBBEAN ISLANDS (Continued)

CURACAO

Liophis triscalis

DOMINICA

Liophis juliae

GUADELOUPE

Liophis juliae

MARIE-GALANTE

Liophis juliae

MARTINIQUE

Liophis cursor

SAINT LUCIA

Liophis ornatus

TOBAGO

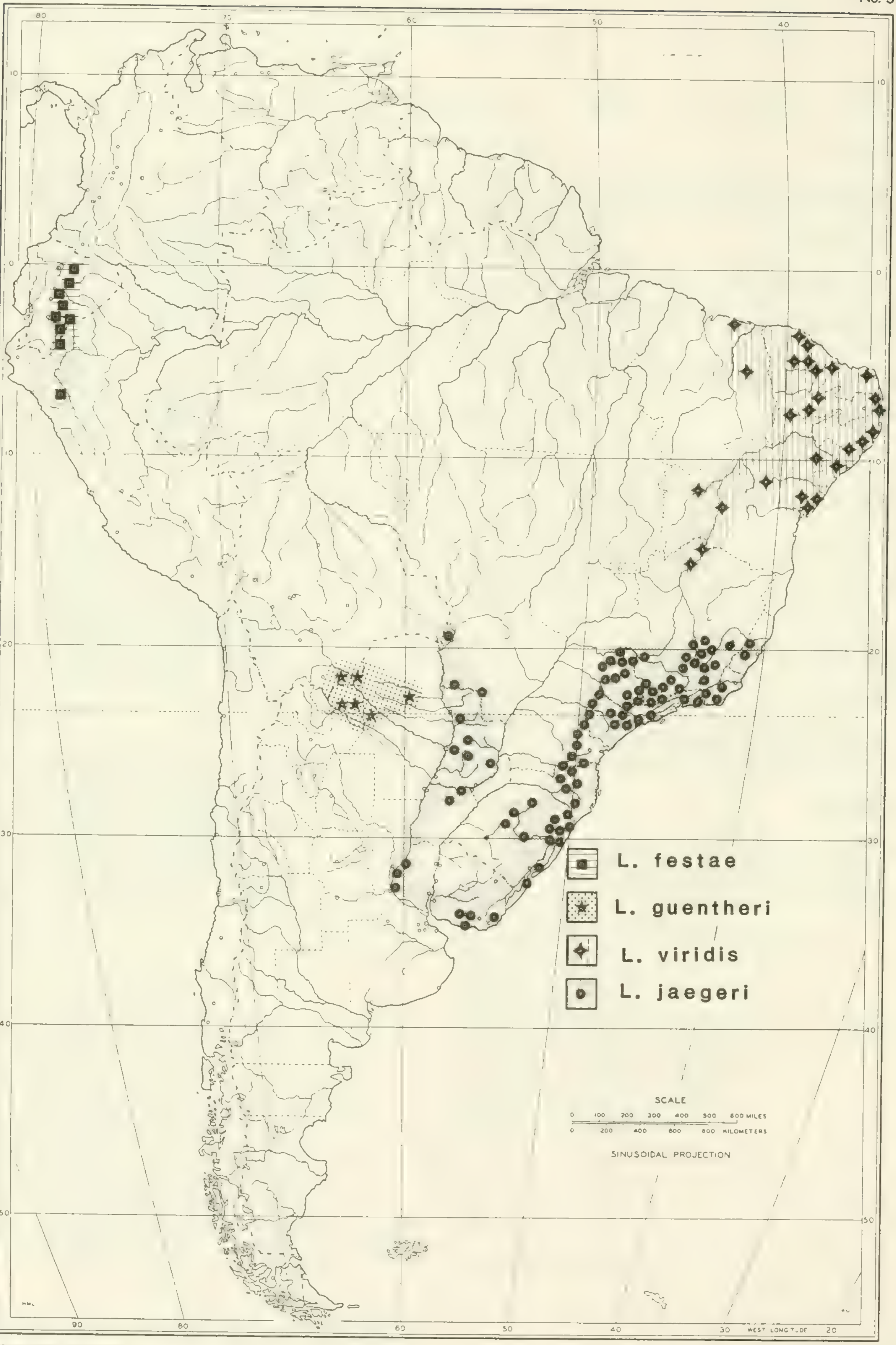
Liophis melanotus
Liophis reginae

TRINIDAD

Liophis cobellus cobellus
Liophis melanotus subsp.
Liophis reginae zweifeli

SOUTH AMERICA

No. 3



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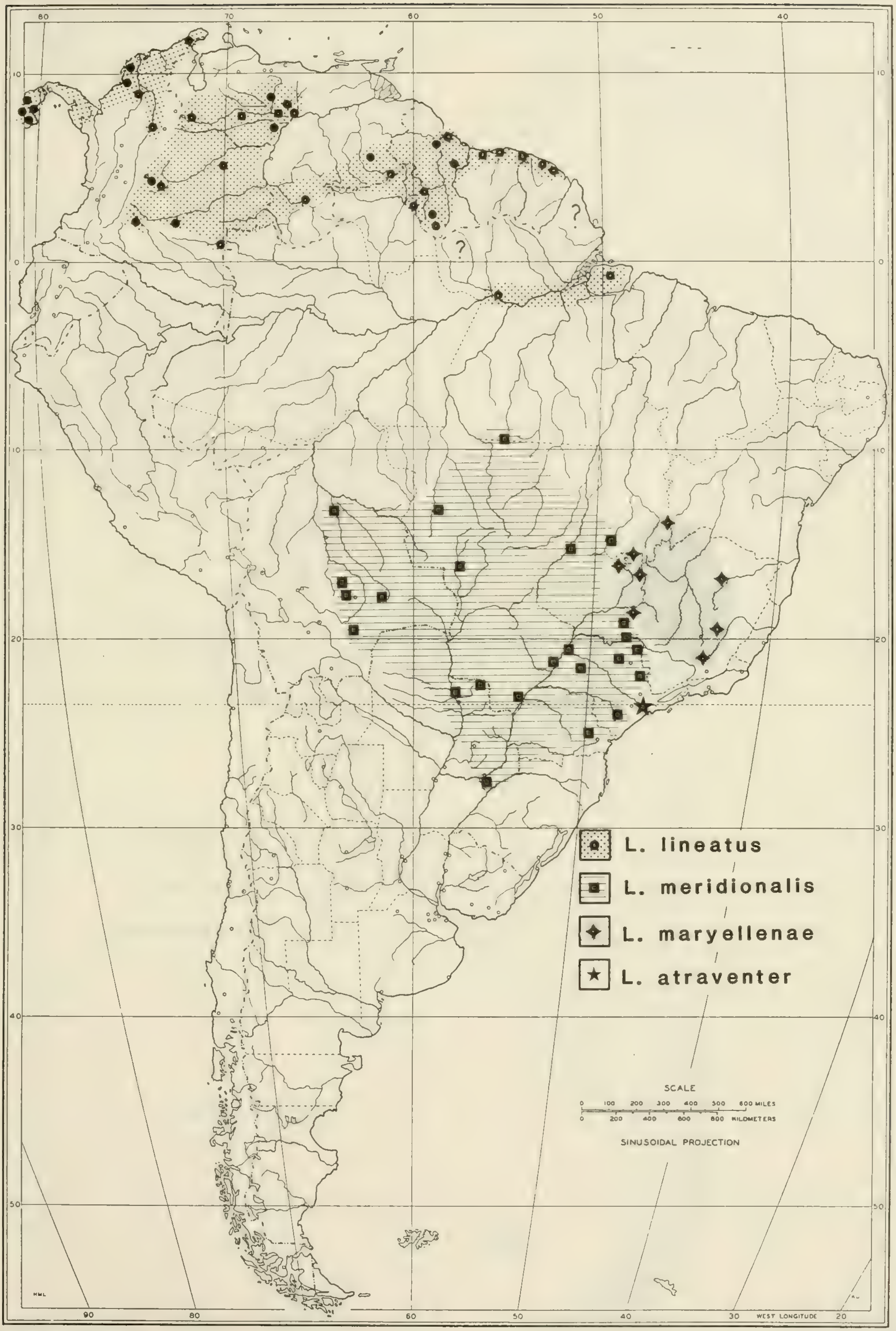
SOUTH AMERICA

No. 3



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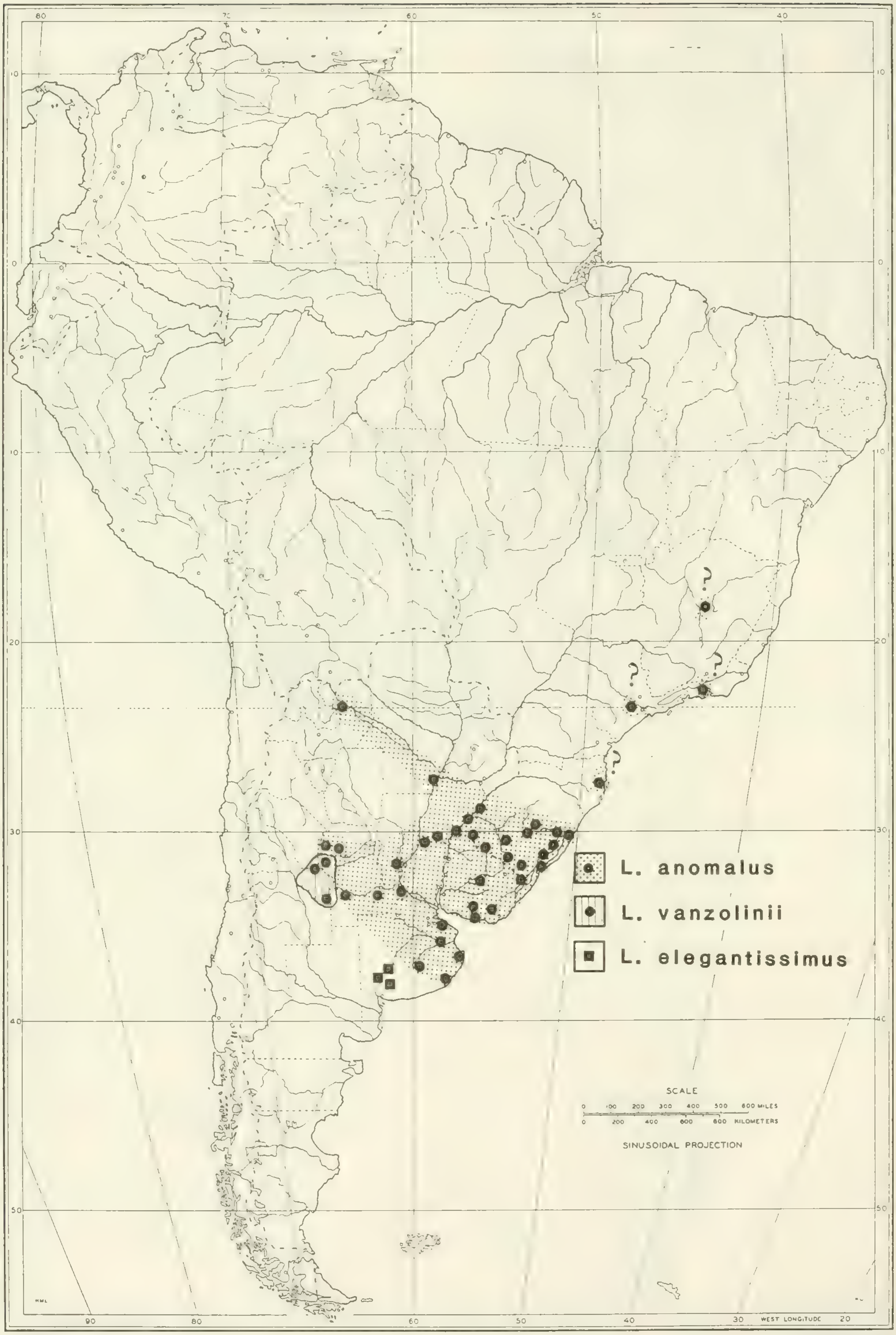
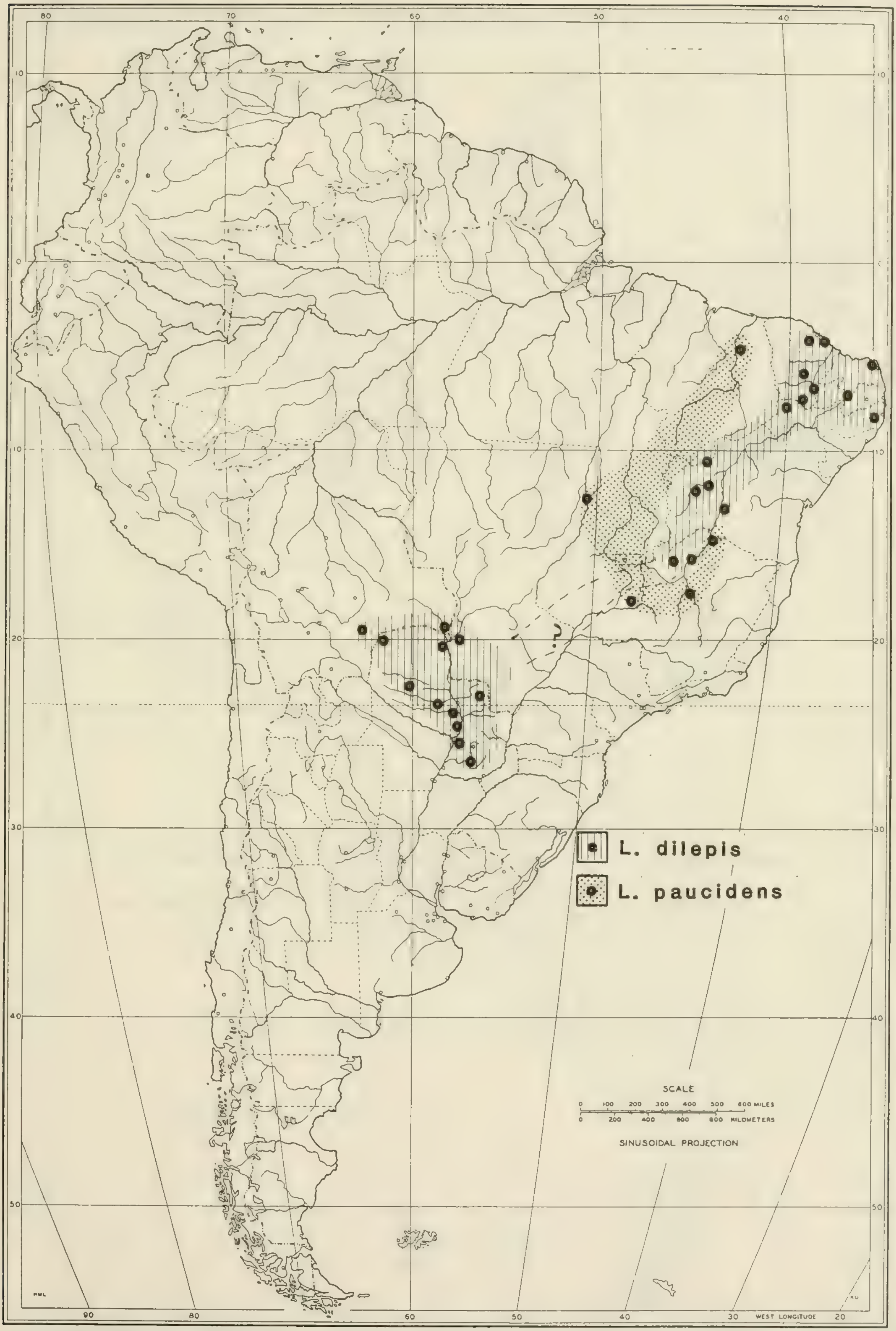

L. anomalus
L. vanzolinii
L. elegantissimus
SCALE
0 100 200 300 400 500 600 MILES
0 200 400 600 800 KILOMETERS
SINUSOIDAL PROJECTION
WEST LONGITUDE


L. dilepis
L. paucidens
SCALE
0 100 200 300 400 500 600 MILES
0 200 400 600 800 KILOMETERS
SINUSOIDAL PROJECTION
WEST LONGITUDE

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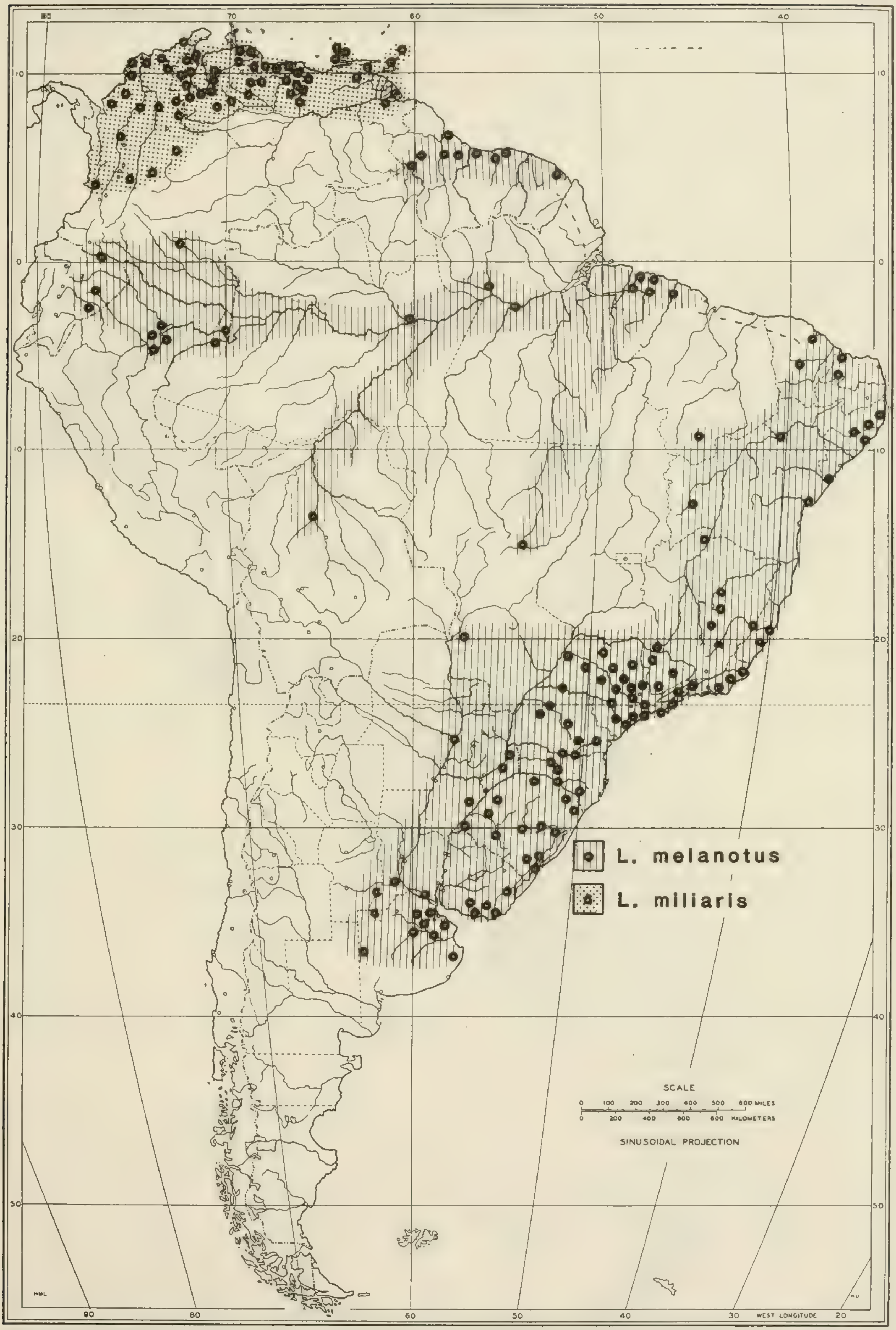

L. melanotus
L. miliaris
SCALE
0 100 200 300 400 500 600 MILES
0 200 400 600 800 KILOMETERS
SINUSOIDAL PROJECTION
WEST LONGITUDE


L. poecilogyrus
L. taeniurus
SCALE
0 100 200 300 400 500 600 MILES
0 200 400 600 800 KILOMETERS
SINUSOIDAL PROJECTION
WEST LONGITUDE

SOUTH AMERICA

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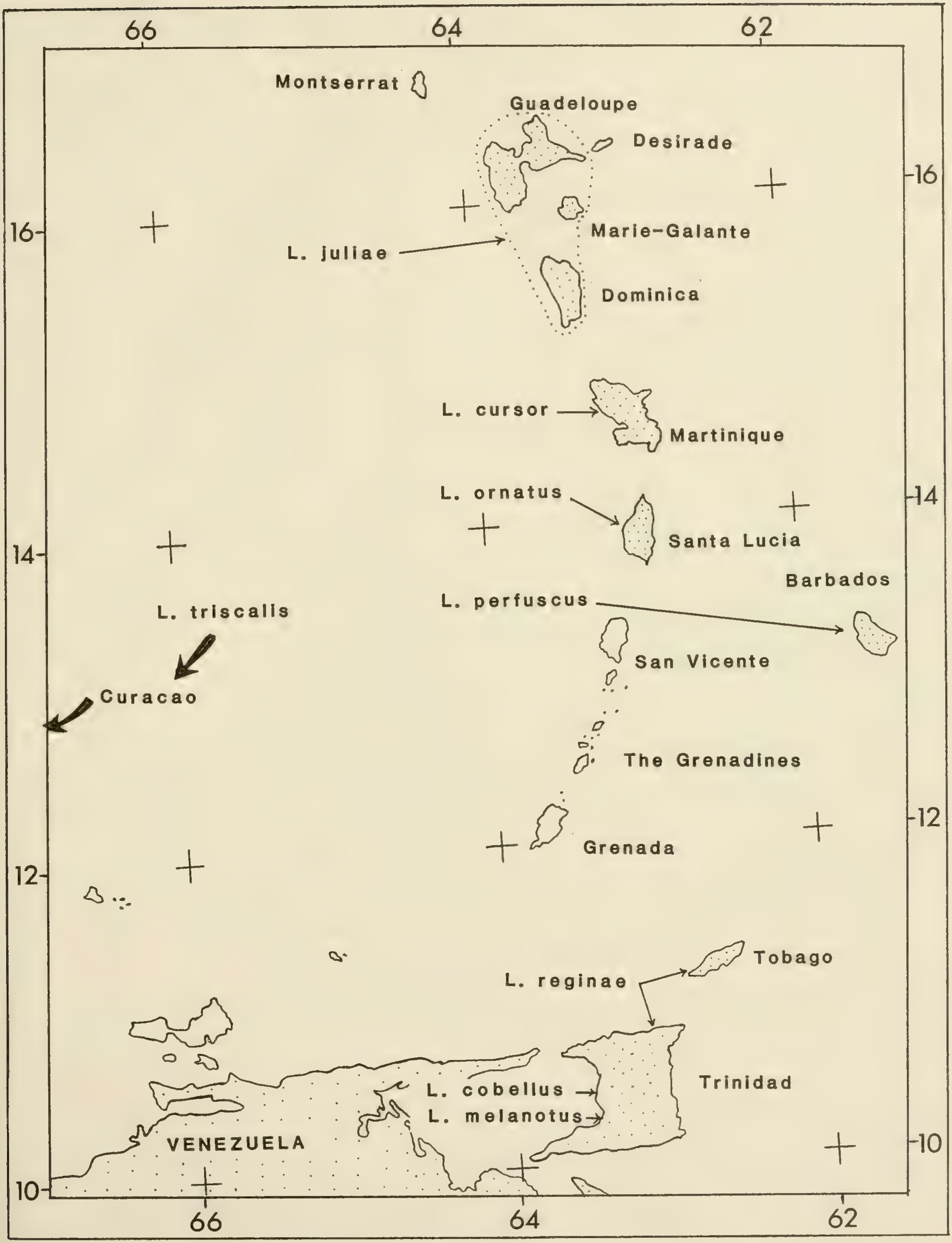
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A SURVEY OF OFFICIALLY REJECTED NOMINAL HERPETOLOGICAL TAXA AND THEIR ALLOCATIONS

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INTRODUCTION

All herpetologists undertaking taxonomic work should utilize the recent summary (Melville and Smith, 1987) of all names and works placed through 1985 on the Official Lists and Indices of the International Commission on Zoological Nomenclature (available, together with a mimeographed supplement covering 1986-1988, from the International Trust for Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London SW7 5BD, England (£60 or $110), or from the American Association for Zoological Nomenclature, c/o NHB Stop 163, National Museum of Natural History, Washington, DC 20560 U.S.A. ($110 or $100 to members of A.A.Z.N.)).

Although a mandatory reference for much taxonomic work, Melville and Smith's compilation contains no indication of the major group of animals to which individual rejected names belong, and no index to these for any such group. Conserved names are allocated to animal group, and are listed in an index for each group, but rejected names are not so treated. Our goal here is thus to provide a list of all rejected names of amphibians and reptiles, inasmuch as those names, as well as available ones, need to be dealt with in synoptic taxonomic works.

Our list has been drawn exclusively from Melville and Smith (1987), except for names appearing in more recent Opinions, through no. 1517, 1988. Opinion numbers follow only those entries published after 1985. Although assuredly the survey is complete for Opinions 1369 et seq., since we have examined all of them, no attempt has been made to examine all of the first 1368 Opinions, since they are covered in Melville and Smith's work. However, our recognition of suppressed herpetological names depended upon familiarity with them or the cited works, since the major group to which any rejected name pertains was never given (and was not in earlier Indexes). Hence some names may inadvertently have been missed.

A total of 12 family-group names, 87 genus-group names and 101 species-group names is included in the following survey, alphabetically arranged in each group. Appended cross-indexes arrange all 200 names in accordance with the nine orders of amphibians and reptiles to which they belong.

Acknowledgments. We are much indebted to Drs. Kraig Adler and Jeremy D.D. Smith, who kindly reviewed the ms and offered numerous suggestions for its improvement.

FAMILY-GROUP NAMES

AGAMOIDEA Fitzinger, 1826, Neue Classif. Rept.: 11, 17 (an incorrect original spelling for Agamidae Fitzinger, 1826, as

corrected; non-existent nomenclaturally; type genus Agama Daudin, 1802).

AMBYSTOMIDAE Hallowell, 1856, Proc. Acad. Nat. Sci. Philadelphia 8:11 (an incorrect original spelling for Ambystomatidae Hallowell, 1856, as corrected; non-existent nomenclaturally; type genus Ambystoma Tschudi, 1838).

CAECILIIDAE Rafinesque-Schmaltz, 1814, Specc. Sci. Giorn. Encicl. Sicilia 2:104 (an incorrect original spelling of Caeciliaidae Rafinesque-Schmaltz, 1814, as corrected; non-existent nomenclaturally; type genus Caecilia Linnaeus, 1758). Op. 1462.

CECILINIA Rafinesque-Schmaltz, 1814, Specc. Giorn. Encicl. Sicilia 2:104 (an incorrect original spelling of Caeciliaidae Rafinesque-Schmaltz, 1814, as corrected; non-existent nomenclaturally; type genus Caecilia Linnaeus, 1758). Op. 1462.

HATTERIIDAE Cope, 1864, Proc Acad. Nat. Sci. Philadelphia 16:227 (suppressed in priority but not homonymy contexts, making it a jr. synonym of Sphenodontidae Cope, 1870, the earliest available family-group name for its family; type genus Hatteria Gray, 1842, a jr. synonym of Sphenodon Gray, 1831).

LEIOPELMIDAE Turbot, 1942, Trans. Roy. Soc. New Zealand 71:247 (a jr. synonym of Leiopelmatidae Mivart, 1869; type genus Leiopelma Fitzinger, 1861).

LIOPELMATINA Mivart, 1869, Proc. Zool. Soc. London 1869: 291 (an incorrect original spelling of Leiopelmatidae Mivart, 1869, as corrected; non-existent nomenclaturally; type genus Leiopelma Fitzinger, 1861).

LIOPELMIDAE Noble, Am. Mus. Novitates (132): 9(a jr. synonym of Leiopelmatidae Mivart, 1869, as corrected; type genus Leiopelma Fitzinger, 1861).

RHYNCHOCEPHALIDAE Hoffmann, 1881, Bronn's Klass. Ordn. Thierr. 6(3):1065 (invalid because name of its type genus, Rhynchocephalus Owen, 1845, is a jr. homonym of Rhynchocephalus Fischer von Waldheim, 1806, a dipterous insect; Owen's name is also a jr. synonym of Sphenodon Gray, 1831, and Hoffmann's name is a jr. synonym of Sphenodontidae Cope, 1870).

STELLIONIDAE Bell, 1825, Zool. J. 1:457 (ruled invalid because its type genus, Stellio Daudin, 1802, was drawn from Stellio Laurenti, 1786, a nomen dubium because its type species, S. saxatilis, is unidentifiable; neither Laurenti name has been rejected, however, and Stellio has commonly been regarded as an invalid sr. synonym of Agama Daudin, 1802; the family name is likewise an invalid sr. synonym of Agamidae Gray, 1827.

STELLIONIDAE Gray, 1825, Ann Philos. (2) 10:196(invalid as a jr. synonym of Stellionidae Bell, and also for the same reason that Bell's name is invalid).

TUPINAMBIDAE Gray, 1825, Ann. Philos., (2) 10:199 (unavailable and non-existent nomenclaturally because the name of the type genus, Tupinambis Daudin, 1802, was not regarded as valid when the family-group name was established; hence the name Tupinambidae cannot replace the currently accepted name Teiidae Gray, 1827, as it would otherwise do).

GENUS-GROUP NAMES

Acrodytes Fitzinger, 1843, Syst. Rept.: 30 (suppressed in priority but not in homonymy contexts, in favor of Phrynohyas Fitzinger, 1843:30, both having the same type species, Hyla venulosa Laurenti, 1768).

Ahaetulla Gray, 1825, Ann. Philos. (2)10:208 (invalid as a jr. homonym of Ahaetulla Link 1807, type species Ahaetulla mycterizans Link, 1807; a jr. synonym of the earlier Leptophis Bell, 1825, having the same type species, Coluber ahaetulla Linnaeus, 1758).

Amblystoma Agassiz, 1846, Nomencl. Zool. 6(Rept.): 2 (an unjustified emendation and jr. synonym of Ambystoma Tschudi, 1838). The date 1846, given in Opinion 649, is not correct. Vanzolini (1977:64) has shown that the probable year of publication of fascicle 6, containing reptiles and amphibians, was 1844, and certainly not later than 1845.

Amplycephalus Kuhl and van Hasselt, 1822, Algemeene Konsten Letterbode, Haarlem 1: 101 (rejected in priority but not in homonymy contexts to protect Pareas Wagler, 1830, and Cemophora Cope, 1860, since the two species most logically assignable as type of Amplycephalus (no species were originally included in the genus) belong one to Pareas, one to Cemophora, as now interpreted; since application of the rules of the Code was not suspended, Coluber coccineus Blumenbach, 1788, has to be accepted as the type species of Amplycephalus, which is thus now a jr. synonym of Cemophora, of which Blumenbach's name is the type species).

Anaides Baird, 1851, Heck's Icon. Encyclop. Sci. 2:256 (an erroneous original spelling of Aneides Baird, 1851:257, hence non-existent nomenclaturally; also a jr. homonym of Anaides Westwood, 1842, for a beetle). As pointed out by Smith and Smith (1973:11) Heck's vol. 2 was not published in 1849 as

often cited, although as stated on the verso of the title page its publication was authorized in 1849.

Anodon Smith, 1829, Zool. J. 4:143 (although this name is antedated by Anodon Oken, 1815, a mollusc, the latter work has been rejected for nomenclatural purposes (Opinion 417), hence Anodon Smith is available; since its type species, Coluber scaber Linnaeus, 1758, is the same as that of Dasypeltis Wagler, 1830, Smith's name was suppressed in priority but not in homonymy contexts, thereby becoming a jr. synonym of Wagler's name).

Asthenognathus Bocourt, 1884, Bull. Sci. Soc. Philomath. Paris (7)8:149 (a jr. homonym of Asthenognathus Stimpson, 1858, a crustacean; the name is a jr. synonym of Sibon Fitzinger, 1826, since its type species, Petalognathus multifasciatus Jan, 1884, is a jr. synonym of Sibon d. dimidiata (Günther, 1872)).

Autodax Boulenger, 1887, Ann. Mag. Nat. Hist. (5)19:67 (a jr. synonym of Aneides Baird, 1851, having the same type species, Salamandra lugubris Hallowell, 1849; proposed as a substitute for Anaides Baird, 1851 (q.v.)).

Axolot Bonaparte, 1831, Giorn. Arcad. Sci. Lett. Arti 49:77 (suppressed in priority but not in homonymy contexts to protect Ambystoma Tschudi, 1838, of which it is now a jr. synonym, since its type species, Siren pisciformis Shaw, 1802, is a jr. synonym of Ambystoma mexicanum (Shaw, 1798)).

Axolotus Jarocki, 1822, Zoologiia 3:179 (suppressed in priority but not in homonymy contexts to protect Ambystoma Tschudi, 1838, of which it is now a jr. synonym, since its type species, Siren pisciformis Shaw, 1802, is a jr. synonym of Ambystoma mexicanum (Shaw, 1798)).

Berus Oken, 1816, Lehrb. Naturgeschichte 3:234 (Oken's work has been rejected for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally and should not be cited as a synonym of anything).

Brachypus Fitzinger, 1826, Neue Classif. Rept.:20,50 (a jr. homonym of Brachypus Meyer, 1814, a bird; a sr. but invalid synonym of Bachia Gray, 1845, since its type species is Brachypus cuvieri Fitzinger, 1826, now Bachia cuvieri (Fitzinger, 1826)).

Centrocercus Fitzinger, 1843, Syst. Rept.:18,86 (a jr. homonym of Centrocercus Swainson, 1832, a bird, hence not valid; a jr. synonym of Uromastyx Merrem, 1820, since its type species is

Uromastix griseus Cuvier, 1827, a jr. synonym of *Uromastyx hardwickii* Gray, 1827).

Chemelys Rafinesque-Schmaltz, 1832, Atl. J. and Friend of Knowledge 1:64 (suppressed in priority but not in homonymy contexts to protect *Rhinoclemmys* Fitzinger, 1835, of which it is now a jr. synonym, since its type species, *Testudo verrucosa* Walbaum, 1782, is a jr. synonym of *Rhinoclemmys punctularia* (Daudin, 1802)).

Cobra Laurenti, 1768, Specimen Medicum:103 (suppressed in priority but not homonymy contexts to protect *Bitis* Gray, 1842, of which it is now a jr. synonym, since its type species, *Coluber atropos* Linnaeus, 1758, now *Bitis atropos* (Linnaeus) is congeneric with *Vipera* (*Echidna*) *arietans* Merrem, 1820, the type species of *Bitis* and a conserved List name.)

Constrictor Laurenti, 1768, Specimen Medicum:106 (a jr. synonym of *Boa* Linnaeus, 1758, having the same type species, *Boa constrictor* Linnaeus, 1758, of which *Constrictor formosissimus* Laurenti, 1768, the type species of *Constrictor*, is a jr. synonym).

Cora Jan, 1863, Elenco Sist. Ofidi:74 (a jr. homonym of *Cora* Selys, 1853, for an odonate insect; type species *Regina kirtlandii* Kennicott; *Clonophis* Cope, 1888, with the same type species, is thus the oldest generic name for that species).

Coriudo Fleming, 1822, Phil. Zool. 2:271 (a jr. synonym of *Dermochelys* Blainville, 1816, having the same type species, *Testudo coriacea* Vandelli, 1761).

Crocodilus Bertrand, 1763, Dict. Univ. Foss. Propres Foss. Accid. 1:183 (Bertrand's work has been rejected for nomenclatural purposes (Opinion 592), and therefore names appearing therein do not exist in nomenclatural contexts; none should be assigned in synonymy to anything).

Dendraspis Fitzinger, 1843, Syst. Rept.:28 (suppressed in priority but not in homonymy contexts in order to protect *Ophiophagus* Günther, 1864, type species *Hamadryas elaps* Günther, 1858, a jr. synonym of *Naja hannah* Cantor, 1836, of which the type species of *Dendraspis* [not to be confused with *Dendroaspis* Schlegel, 1848], *Naja bungarus* Schlegel, 1837, is also a jr. synonym).

Dendrophis Boie, 1826, *in* Fitzinger, Neue Classif. Rept.:29 (a jr. synonym of *Leptophis* Bell, 1825, having the same type species, *Coluber ahaetulla* Linnaeus, 1758).

Dermatochelys Wagler, 1830, Natürl. Syst. Amph.:133 (a jr. synonym of Dermochelys Blainville, 1816, having the same type species, Testudo coriacea Vandelli, 1761).

Dermochelis Lesueur, 1829, in Cuvier, Règne Anim., Ed. 2, 2:14 (an incorrect subsequent spelling of Dermochelys Blainville, 1816; without nomenclatural status but commonly cited in synonymy of the latter name).

Diemichylus Cope, 1859, Proc. Acad. Nat. Sci. Philadelphia 11:128 (an incorrect subsequent spelling of Diemictylus Rafinesque, 1820; without nomenclatural status but commonly cited in synonymy of Notophthalmus Rafinesque, 1820, of which Diemictylus is a jr. synonym).

Diemyctelus Günther, 1901, Biologia Centrali-Am., Rept. Batr.:294 (an incorrect subsequent spelling of Diemictylus Rafinesque, 1820; without nomenclatural status but commonly cited in synonymy of Notophthalmus Rafinesque-Schmaltz, 1820, of which Diemictylus is a jr. synonym).

Diemyctylus Hallowell, 1856, Proc. Acad. Nat. Sci. Philadelphia 8:6-11 (an unjustified emendation of Diemictylus Rafinesque, 1820; an available but invalid jr. synonym of Notophthalmus Rafinesque, 1820, of which Diemictylus is a jr. synonym).

Discosomus Oken, 1816, Lehrb. Naturgeschichte 3:310 (Oken's work has been rejected for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally and should not be cited as a synonym of anything).

Draco Oken, 1816, Lehrb. Naturgeschichte 3:273 (same fate as Discosomus, preceding).

Dracunculus Wiegmann, 1834, Herp. Mex.:14 (a jr. homonym of Dracunculus Reichard, 1759, a nematode; type species Draco lineatus Daudin, 1802; hence a jr. synonym of Draco Linnaeus, 1758).

Dryinus Merrem, 1820, Tent. Syst. Amph.:15,136 (a jr. homonym of Dryinus Latreille, 1804, an insect, and a jr. synonym of Ahaetulla Link, 1807, having the same type species, A. mycterizans Link, 1807).

Dryophis Dalman, 1823, Anat. Entomol.:7 (a jr. synonym of Ahaetulla Link, 1807, having the same type species, A. mycterizans Link, 1807).

Enhydrus Rafinesque-Schmaltz, 1815, Analyse Nature:77 (an incorrect subsequent spelling of Enhydris Latreille, 1802;

without nomenclatural status but commonly cited in synonymy of the latter name).

Epirhexis Cope, 1866, J. Acad. Nat. Sci. Philadelphia (2)6:96 (rejected for priority but not homonymy purposes (Opinion 1024), to protect Syrrhophus Cope, 1878, since its type species, Batrachyla longipes Baird, 1859, is congeneric with the type species of Syrrhophus, namely S. marnockii Cope, 1878).

Eremiophilus Fitzinger, 1843, Syst. Rept.:32 (rejected in priority but not homonymy contexts in order to protect Kassina Girard, 1853, both having the same type species, Cystignathus senegalensis Duméril and Bibron, 1841).

Hamadryas Cantor, 1836, Asiatick Res. 19:87 (a jr. homonym of Hamadryas Hübner, 1808, a lepidopteran insect, and a sr. synonym, although invalid, of Ophiophagus Günther, 1864, type species Naja elaps Schlegel, 1843, a jr. synonym of Hamadryas hannah Cantor, 1836, type species of its genus). The original description of Hamadryas Cantor did not appear, as indicated in Opinion 789, in 1838 (Cantor, 1838), but in 1836 (Cantor, 1836). The 1836 description named the sole species (hence the type species) H. hannah, whereas the 1838 description named the sole species H. ophiophagus, without mention of the earlier name H. hannah.

Hatteria Gray, 1842, Zool. Misc. (2):72 (a jr. synonym of Sphenodon Gray, 1831, having the same type, Hatteria punctata Gray, 1842).

Herpeton Oken, 1816, Lehrb. Naturgeschichte 3:282 (this work by Oken has been rejected for nomenclatural purposes, hence the name does not exist nomenclaturally and should not be cited as a synonym of anything).

Ibiba Gray, 1825, Ann. Phil. 10:209 (rejected in priority but not homonymy contexts to protect Boiga Fitzinger, 1826, since both have the same type species, Coluber irregularis Merrem). Op. 1374.

Liopelma Günther, 1868, Proc. Zool. Soc. London 36:478 (an unjustified emendation of Leiopelma Fitzinger, 1861; an available but invalid jr. synonym of the latter name).

Mabouia Cuvier, 1829, Règne Animal, Ed. 2, 2:62 (an incorrect subsequent spelling of Mabuya Fitzinger, 1826; without nomenclatural status but commonly cited in synonymy of the latter name).

Mabouya Duméril and Bibron, 1839, Erp. Gén. 5:663, 671 (an incorrect subsequent spelling of Mabuya Fitzinger, 1826; without nomenclatural status but commonly cited in synonymy of the latter name).

Mabuia Cuvier, 1829, Règne Animal, Ed. 2, 2:64 (an incorrect subsequent spelling of Mabuya Fitzinger, 1826; without nomenclatural status but commonly cited in synonymy of the latter name).

Mabuya Rafinesque-Schmaltz, 1815, Analyse Nature:76 (a nomen nudum, without nomenclatural status, antedating but not displacing Mabuya Fitzinger, 1826).

Notophthalma Gray, 1858, Proc. Zool. Soc. London 26:138 (an incorrect subsequent spelling of Notophthalmus Rafinesque, 1820; without nomenclatural status but commonly cited in synonymy of the latter name).

Notophthalmia Gray, 1850, Cat. Batr. Grad. Brit. Mus.:22 (an incorrect subsequent spelling of Notophthalmus Rafinesque, 1820; without nomenclatural status but commonly cited in synonymy of the latter name).

Notopthalmus Baird, 1850, J. Acad. Nat. Sci. Philadelphia (2)1(4):284 (an incorrect subsequent spelling of Notophthalmus Rafinesque, 1820; without nomenclatural status but commonly cited in synonymy of the latter name).

Oedipus Tschudi, 1838, Mém. Soc. Sci. Nat. Neuchâtel 2:28 (invalid as a jr. homonym of Oedipus Berthold, 1827, for an orthopteran insect, itself suppressed in priority but not in homonymy contexts to restore order in nomenclature of the genus now accepted as Bolitoglossa Duméril, Bibron and Duméril, 1854, whose type species is Salamandra platydactylus Gray, 1831, the same as for Oedipus Tschudi).

Ophidion Pomel, 1853, Cat. Méth. Vert. Foss. Loire:128 (a jr. homonym of Ophidion Linnaeus, 1758, for a fish; Ophidioniscus a substitute name, Kuhn, 1963; type species Ophidion antiquus Pomel, 1853; a fossil snake probably referable to Boidae).

Palaeotriton Fitzinger, 1837, Ann. Wien. Mus. Naturgesch. 2:186 (rejected in priority but not homonymy contexts to protect Andrias Tschudi, 1837, type Salamandra scheuchzeri Holl, 1831; Palaeotriton type species Salamandra gigantea Meyer, 1832, a jr. synonym of S. scheuchzeri and also a jr. homonym of Salamandra gigantea Barton, 1808, a jr. synonym of Cryptobranchus alleganiensis Daudin, 1802).

Palmatotriton Smith, 1945, Ward's Nat. Sci. Bull. 19(1):4 (ruled a nomen nudum, without nomenclatural status; now incorrectly cited as a jr. synonym of Bolitoglossa Duméril, Bibron and Duméril, 1854, based on Bolitoglossa rufescens (Cope, 1869)).

Passerita Gray, 1825, Ann. Philos. 26:208 (a jr. synonym of Ahaetulla Link, 1807, both having the same type species, A. mycterizans Link, 1807).

Petrodactylus Oken, 1816, Lehrb. Naturg. 3:index (this work by Oken has been rejected for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally and should not be cited as a synonym of anything).

Philhydrus Brookes, 1828, Prodr. Syn. Anim. Brookesian Mus.:16 (rejected in priority but not homonymy contexts to protect Ambystoma Tschudi, 1838; type species Siren pisciformis Shaw, 1802, a jr. synonym of Gyrinus mexicanus Shaw, 1798).

Philodendros Fitzinger, 1843, Syst. Rept.:26 (rejected in priority but not homonymy contexts to protect Dromophis Peters, 1869, both having the same type species, Dendrophis praeornata Schlegel, 1837). Op. 1384.

Philodendrus Agassiz, 1846, Nomencl. Zool. Index Univ.:285 (an unjustified emendation of Philodendros Fitzinger, 1843; an available but invalid jr. synonym of Dromophis Peters, 1869). Op. 1384.

Phyllhydrus Gray, 1831, in Griffith's Cuvier, Anim. Kingd. 9, Syn. Spec.: 108 (rejected in priority but not homonymy contexts to protect Ambystoma Tschudi, 1838; type species Siren pisciformis Shaw, 1802, a jr. synonym of Gyrinus mexicanus Shaw, 1798).

Propus Oken, 1816, Lehrb. Naturg. 3:287 (this work by Oken has been rejected for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally and should not be cited as a synonym of anything).

Proteocordylus Eichwald, 1831, Zoologia Specialis (3):165 (rejected in priority but not in homonymy contexts to protect Andrias Tschudi, 1837; type species P. diluvii Eichwald, 1831, a jr. synonym of Salamandra scheuchzeri Holl, 1831, type species of Andrias.

Pterodactylus Oken, 1816, Lehrb. Naturg. 3:312 (this work by Oken has been rejected for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally and should not be cited as a synonym of anything).

Rhinaspis Fitzinger, 1843, Syst. Rept.:25 (ruled a nomen nudum, as its type species, *R. proboscideum* Fitzinger, 1843, is a nomen nudum; neither name exists nomenclaturally but both are commonly cited in the synonymy of *Simophis* Peters, 1860, and its type species, *Heterodon rhinostoma* Schlegel, 1837; their synonymy includes Jan's 1863 occupation of Fitzinger's nomina nuda, as *Rhinaspis proboscideus*).

Rhinosimus Duméril, Bibron and Duméril, 1854, Erp. Gén. 7:991 (a jr. homonym of *Rhinosimus* Latreille, 1802, a genus of beetles; type species *Rhinosimus guerini* Duméril, Bibron and Duméril, 1854, now placed in *Phimophis* Cope, 1860, as its type species).

Rhinostoma Fitzinger, 1826, Neue Classif. Rept.:56,29 (rejected in priority but not homonymy contexts to protect *Lystrophis* Cope, 1885, type species *Heterodon dorbignyi* Duméril, Bibron and Duméril, of which *Vipera nasua* Wagler, 1830, is a jr. synonym through rejection in priority but not homonymy contexts; *Rhinostoma* was diagnosed but without an acceptable species, although two nomina nuda were named; subsequently *Vipera nasua* was designated type species).

Rhynchocephalus Owen, 1845, Trans. Geol. Soc. London (2)7:78 (a jr. synonym of *Sphenodon* Gray, 1831, having the same type species, *Hatteria punctata* Gray, 1842; also a jr. homonym of *Rhynchocephalus* Fischer von Waldheim, 1806, for a dipterous insect).

Scinci Oken, 1816, Lehrb. Naturg. 3:300 (this work by Oken has been suppressed for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally and should not be cited in the synonymy of anything).

Scincorum Oken, 1816, Lehrb. Naturg. 3:index (as in the preceding account for *Scinci*).

Siredon Wagler, 1830, Syst. Amph.:209,210 (rejected in priority but not in homonymy contexts to protect *Ambystoma* Tschudi, 1838; type species *S. axolotl* Wagler, 1830, a jr. synonym of *Gyrinus mexicanus* Shaw, 1898, now in *Ambystoma*).

Sirena Fischer von Waldheim, 1808, Zoognosia, Ed. 2:tab. iii (an unjustified emendation of *Siren* Linnaeus, 1766; an available but invalid jr. synonym of the latter name).

Sirene Oken, 1816, Lehrb. Naturg. 3:187 (this work by Oken has been rejected for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally and should not be cited as a synonym of anything; the name is also an unjustified emendation of *Siren* Linnaeus, 1766, as well as a jr. homonym of

an earlier, identical emendation, Sirene Link, 1794, which is a citeable jr. synonym of Siren).

Sirenodon Wiegmann, 1832, in Wiegmann and Ruthe, Handb. Zool., Ed. 2:204 (rejected in priority but not homonymy contexts to protect Ambystoma Tschudi, 1838; type species Siredon axolotl Wagler, 1830, a jr. synonym of Gyrinus mexicanus Shaw, 1798, now assigned to Ambystoma).

Sphaenodon Gray, 1831, Zool. Misc. (1):14 (ruled an incorrect original spelling, non-existent nomenclaturally, of Sphenodon Gray, 1831, type species, Hatteria punctata Gray, 1842; emended first to Sphenodon by Gray, 1872, and thus accepted by the ICZN).

Sphalerosophis Jan, 1865, in Filippi, Note Viaggio Persia:356 (an incorrect original spelling and jr. synonym of Spalerosophis Jan, 1865; Sphalerosophis Jan is therefore non-existent nomenclaturally).

Sphargis Merrem, 1820, Tent. Syst. Amph.:19 (a jr. synonym of Dermochelys Blainville, 1816, having the same type species, Testudo coriacea Vandelli, 1761; in the case of Sphargis, through a jr. synonym of T. coriacea, S. mercurialis Merrem, 1820).

Stegoporus Wiegmann, 1832, in Wiegmann and Ruthe, Handb. Zool., Ed. 2:204 (rejected in priority but not homonymy contexts in order to protect Ambystoma Tschudi, 1838; proposed as a substitute for Siredon Wagler, 1830, a jr. synonym of Gyrinus mexicanus Shaw, 1898, now in Ambystoma).

Stellio Daudin, 1802, Hist. Nat. Rept. 4:5 (a jr. homonym of Stellio Laurenti, 1768, a nomen dubium because its type species, S. saxatilis, is unidentifiable; neither Laurenti name has been rejected officially, however, and Stellio Laurenti has commonly been regarded as an invalid sr. synonym of Agama Daudin, 1802).

Tachyophis Mertens, 1934, Arch. Naturg. (n.f.) 3:197 (invalid as a jr. homonym of Tachyophis Rochebrune, 1884, a fossil snake; type species Coluber pictus Gmelin, 1788, now placed in Dendrelaphis Boulenger, 1890, as a valid species).

Tapaia Oken, 1816, Lehrb. Natur. 3:vi (index) (this work by Oken has been rejected for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally, as of Oken, 1816, and should not be cited in the synonymy of anything, although commonly referred to Phrynosoma Wiegmann, 1828; also an incorrect original spelling of Tapaia Oken, 1816, q. v.).

Tapaia Oken, 1817, Isis von Oken 1817:1183 (rejected in priority but not in homonymy contexts to protect _Phrynosoma_ Wiegmann, 1828, having the same type species, _Lacerta_ _orbicularis_ Linnaeus, 1758).

Tapaja Oken, 1816, Lehrb. Naturg. 3:295 (this work by Oken was rejected for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally, and should not be cited in the synonymy of anything).

Tapaya Fitzinger, 1826, Neue Classif. Rept.:17 (rejected in priority but not homonymy contexts to protect _Phrynosoma_ Wiegmann, 1828, having the same type species, _Lacerta_ _orbicularis_ Linnaeus, 1758).

Tapaya Oken, 1817, Isis von Oken 1817:1183 (an incorrect original spelling of _Tapaia_ Oken, 1817, hence non-existent nomenclaturally).

Tapayia Gray, 1825, Ann. Philos. 26:197 (rejected in priority but not in synonymy contexts to protect _Phrynosoma_ Wiegmann, 1828, having the same type species, _Lacerta_ _orbicularis_ Linnaeus, 1758).

Thermophilus Fitzinger, 1843, Syst. Rept.:21 (rejected in priority but not homonymy contexts to protect _Ichnotropis_ Peters, 1854, both having the same type species, _Algyra_ _capensis_ A. Smith, 1838, in _Thermophilus_ via Fitzinger's _Tropidosaura_ _capensis_ "Duméril and Bibron," in error for A. Smith, and in _Ichnotropis_ via _I_. _macrolepidota_ Peters, 1854, a jr. synonym of _A_. _capensis_ Smith). Op. 1422.

Tortrix Oppel, 1811, Ann. Mus. Nat. Hist. Nat. Paris 16(95):377,381 (rejected as a jr. homonym of _Tortrix_ Linnaeus, 1758, a lepidopteran insect; type species _Anguis_ _scytale_ Linnaeus, 1758, still valid, now referred as type species to the genus _Anilius_ Oken, 1816, of which _Tortrix_ Oppel is a sr. synonym, but invalid).

Tritropis Fitzinger, 1843, Syst. Rept.:59 (rejected in priority but not in homonymy contexts to protect _Chalarodon_ Peters, 1854, having the same type species, _Tropidogaster_ _blainvillii_ Duméril and Bibron, 1837).

Tropidogaster Duméril and Bibron, 1837, Erp. Gen. 4:329 (rejected in priority but not in homonymy contexts to protect _Chalarodon_ Peters, 1854, having synonymous type species; see _blainvillii_ in the species-group list)

Typhlina Wagler, 1830, Nat. Syst. Amph.:196 (rejected in priority but not in homonymy contexts to protect Leptotyphlops Fitzinger, 1843, type species Typhlops nigricans Schlegel, 1839, in which genus Anguis septemstriatus Schneider, 1801, the type species of Typhlina, also belongs).

Zygnis Oken, 1816, Lehrb. Naturg. 3:284 (this work by Oken has been rejected for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally, and should not be cited in the synonymy of anything).

SPECIES-GROUP NAMES

alamose, Kinosternon, Pritchard, 1979, Encyclopedia of Turtles: 556 (rejected in both priority and homonymy contexts to protect K. alamosae Berry and Legler, 1980; a non-existent name, nomenclaturally, that should not be cited as a synonym of anything).

alleghaniensis, Abranchus, Harlan, 1825, Ann. Lyceum Nat. Hist. New York 1(18):271 (an unjustified emendation and jr. synonym of Salamandra alleganiensis Daudin, 1803, now Cryptobranchus alleganiensis (Daudin)).

alligator, Lacerta, Blumenbach, 1779, Handb. Naturg. 1:263 (rejected in priority but not in homonymy contexts to protect Crocodilus mississippiensis Daudin, 1801, now Alligator mississippiensis (Daudin), of which it is a jr. synonym).

areolata, Lacerta, Houttuyn, 1787, Anim. Mus. Houtt. Index: 24 (this work by Houttuyn was suppressed for nomenclatural purposes (Opinion 380), hence this name should not be cited in the synonymy of anything, as it does not exist nomenclaturally, and is in addition unidentifiable).

atratus, Coluber, Gmelin, 1788, in Linnaeus, Syst. Nat., Ed. 13, 1: 1103 (rejected in both priority and homonymy contexts, by Gmelin or any other author, prior to erection of Coluber atratus Hallowell, 1845, now Ninia atrata (Hallowell), in order to protect the latter name; previous usages do not exist nomenclaturally and should not be cited in the synonymy of anything).

besseri, Anguis, Andrzejowski, 1832, Nouv. Mém. Soc. Imp. Nat. Moscou (2)2:338, tab. 22, fig. 7, tab. 24 (rejected in priority but not in homonymy contexts to protect Otophis eryx colchica Nordmann, 1840, now Anguis fragilis colchica, of which A. besseri is now a jr. synonym).

bibronii, Trapelus (Psammorrhoa), Fitzinger, 1843, Syst. Rept.: 81 (rejected in both priority and homonymy contexts to protect Agama bibronii A. Duméril in Duméril and Bibron, 1851; Fitzinger's name was a sr. secondary homonym of Duméril's, having been transferred to the synonymy of Agama hispida aculeata Merrem, 1820; it does not now exist nomenclaturally).

bilineatus, Psammophis moniliger, Peters, 1867, Monatsb. Akad. Wiss. Berlin 1867: 237 (rejected in priority but not in homonymy contexts to protect P. sibilans subtaeniata Peters, 1882, now P. subtaeniata Peters, of which bilineatus is now a jr. synonym).

blainvillii, Tropidogaster, Duméril and Bibron, 1837, Erp. Gen. 4:300 (rejected in priority but not in homonymy contexts to protect Chalarodon madagascariensis Peters, 1854, of which blainvillii is now a jr. synonym).

bosci, Rana, Bory de St. Vincent, 1828, Rés. Erp.: 266 (rejected in priority but not in homonymy contexts, to protect Rana esculenta perezi Seoane, 1885, now Rana perezi Seoane, of which the former is now a jr. synonym).

caesius, Coluber, Cloquet, 1818, Dict. Sci. Nat. 11: 201 (rejected in priority but not in homonymy contexts to protect Coluber irregularis Leach, 1819, now Philothamnus irregularis (Leach), of which the former is now a jr. synonym).

californiana, Aspidonectes, Rivers, 1889, Proc. California Acad. Sci. (2)2: 233-236 (rejected in priority but not in homonymy contexts to protect Trionyx steindachneri Siebenrock, 1906, of which the former is now a jr. synonym).

chiametla, Coluber, Shaw, 1802, Gen. Zool. 3(2): 440 (rejected in priority but not in homonymy contexts to protect Herpetodryas margaritiferus Schlegel, 1838, now Drymobius margaritiferus (Schlegel), and Drymobius margaritiferus fistulosus Smith, 1942, of which Shaw's name is now a jr. synonym).

cincolor, Crotalus durissus, Notestein, 1905, 7th Rep. Michigan Acad. Sci.: 123 (ruled non-existent nomenclaturally because cited only in synonymy, of Crotalus horridus Linnaeus, 1758; presumably a lapsus for concolor, and presumably drawn from Jan, 1859, although the only source stated was "J").

cinereous, Crotalus, Le Conte, 1852, in Hallowell, Proc. Acad. Nat. Sci. Philadelphia 5(5): 177 (rejected in priority but not in homonymy contexts to protect Crotalus atrox Baird and Girard, 1853, of which the former in now a jr. synonym).

coerulea, _Rana_, Houttuyn, 1787, Anim. Mus. Houtt. Index: 19 (this work by Houttuyn has been suppressed for nomenclatural purposes (Opinion 380), hence the name does not exist nomenclaturally and is unidentifiable anyhow).

colonorum, _Agama_, Daudin, 1802, Hist. Nat. Rept. 3: 336 (a jr. objective synonym of _Lacerta agama_ Linnaeus, 1758, now _A. a. agama_ (Linnaeus)).

concolor, _Crotalus durissus_, Garman, 1883, Mem. Mus. Comp. Zool. 8: 175 (ruled non-existent nomenclaturally because cited only in synonymy, of _C. horridus_ Linnaeus, 1758; name attributed to Jan, 1859).

concolor, _Crotalus durissus_, Gloyd, 1940, Spec. Publ. Chicago Acad. Sci. 4:171 (ruled non-existent nomenclaturally because cited only in synonymy, of _C. viridis decolor_ Klauber, 1930; name attributed to Jan, 1859).

concolor, _Crotalus durissus_, Jan, 1859, Rev. Mag. Zool. (2)10: 153 (ruled non-existent nomenclaturally because a nomen nudum).

cruciger, _Bufo_, Oken, 1816, Lehrb. Naturg. 3:209 (this work by Oken has been suppressed for nomenclatural purposes (Opinion 417), hence the name is non-existent nomenclaturally and should not be cited in the synonymy of any species).

cupreus, _Coluber_, Houttuyn, 1787, Anim. Mus. Houtt. Index: 28 (this work by Houttuyn has been suppressed for nomenclatural purposes (Opinion 380), hence the name does not exist nomenclaturally and is unidentifiable).

diglossis, _Chirotes_, Saenz, 1869, An. Univ. Nac. Est. Unidos Colombia 1869: 63 (rejected in priority but not in homonymy contexts to protect _Heteroclonium bicolor_ Cope, 1896, now _Bachia bicolor_ (Cope), of which Saenz' name is now a jr. synonym). Op. 1482.

doliatus, _Coluber_, Linnaeus, 1766, Syst. Nat., Ed. 12, 1:376 (rejected in priority but not in homonymy contexts to protect _Coluber coccineus_ Blumenbach, 1788, now _Cemophora coccinea_ (Blumenbach), of which _doliatus_ is now a jr. synonym).

dorsata, _Testudo_, Schoepff, 1801, Naturg. Schildk.: 158 (rejected in priority but not in homonymy contexts to protect _Testudo punctularia_ Daudin, 1802, now _Rhinoclemmys punctularia_ (Daudin), of which _dorsata_ is now a jr. synonym).

dracaena, _Lacerta_, Linnaeus, 1766, Syst. Nat., Ed. 12, 1: 250 (rejected in priority but not in homonymy contexts to protect

Tupinambis *bengalensis* Daudin, 1802, now *Varanus* *bengalensis* (Daudin), of which *dracaena* is now a jr. synonym).

dubia, *Amphisbaena*, Rathke, 1863, Abh. K.-Bayer. Akad. Wiss. München 9(1): 128 (rejected in both priority and homonymy contexts to protect *Amphisbaena* *dubia* Müller, 1924; Rathke's name is non-existent nomenclaturally but was based on *A*. *fuliginosa* Linnaeus, 1758, and, more precisely, *A*. *f*. *amazonica* Vanzolini, 1951).

elaphis, *Coluber*, Shaw, 1802, Gen. Zool. 3: 450 (rejected in priority but not in homonymy contexts to protect *Coluber* *scalaris* Schinz, 1822, now *Elaphe* *scalaris* (Schinz), of which Shaw's name in now a jr. synonym).

ereticauda, *Triton*, Eschscholtz, 1833, Zool. Atlas 5: 14 (rejected in priority but not in homonymy contexts to protect *Salamandra* *lugubris* Hallowell, 1849, now *Aneides* *lugubris* (Hallowell), of which Eschscholtz' name is now a jr. synonym).

erythronota, *Salamandra*, Rafinesque, 1818, Sci. J. 1: 25 (rejected in priority but not in homonymy contexts to protect *Salamandra* *cinerea* Green, 1818, now *Plethodon* *cinereus* (Green), of which Rafinesque's name is now a jr. synonym).

fasciata, *Lacerta*, Houttuyn, 1787, Anim. Mus. Houtt. Index: 24 (this work by Houttuyn has been rejected for nomenclatural purposes (Opinion 380), hence the name does not exist nomenclaturally, and besides is unidentifiable).

fasciata, *Rana*, Burchell, 1824, Travels Interior South Africa 2: 32 (rejected in priority but not in homonymy contexts to protect *Rana* *grayi* Smith, 1849, of which Burchell's name is now a jr. synonym; in addition, all other uses of *Rana* *fasciata* prior to that of Smith, 1849, are similarly rejected).

flava, *Testudo*, Lacépède, 1788, Hist. Nat. Quad. Ovip. Serpens 1, Synops. Meth.: 135, tab. 16 (rejected in priority but not in homonymy contexts to protect *Cistudo* *blandingii* Holbrook, 1838, now *Emydoidea* *blandingii* (Holbrook), of which Lacépède's name is now a jr. synonym).

flavescens, *Amphisbaena*, Houttuyn, 1787, Anim. Mus. Houtt. Index: 29 (this work by Houttuyn has been suppressed for nomenclatural purposes (Opinion 380), hence the name does not exist nomenclaturally; it is also unidentifiable).

foetidus, *Coluber*, Güldenstedt, 1801, *in* Georgi, Geogr.-Phys. Naturh. Beschreib. Russ. Reich. 3(7): 1884 (rejected in priority but not in homonymy contexts to protect *Pelias* *renardi*

Christoph, 1861, now _Vipera ursinii renardi_, of which _foetidus_ is now a jr. synonym).

formosissimus, _Constrictor_, Laurenti, 1768, Specimen Medicum...: 107 (a jr. objective synonym of _Boa constrictor_ Linnaeus, 1758).

funebris, _Salamandra_, Bory de St. Vincent, 1828, Rés. Erp.: 236 (rejected in priority but not in homonymy contexts to protect _Pleurodeles waltl_ Michahelles, 1830, of which _funebris_ is now a jr. synonym).

galliwasp, _Scincus_, Oken, 1816, Lehrb. Naturg. 3: 299(this work by Oken has been suppressed for nomenclatural purposes (Opinion 417), hence the name is non-existent nomenclaturally and should not be cited in the synonymy of any species).

graecus, _Stellio_, Oken, 1816, Lehrb. Naturg. 3: 202(as in the preceding account of _galliwasp_)

granulatus, _Anguis_, Houttuyn, 1787, Anim. Mus. Houtt. Index: 29 (this work by Houttuyn has been suppressed for nomenclatural purposes (Opinion 380), hence the name does not exist nomenclaturally; it is also unidentifiable).

grisea, _Lacerta_, Oken, 1816, Lehrb. Naturg. 3: 303 (this work by Oken has been suppressed for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally and should not be cited in the synonymy of any species).

indicus, _Crocodilus vulgaris_, Gray, 1831, Syn. Rept.: 58 (rejected in priority but not in homonymy contexts to protect _Crocodilus palustris_ Lesson, 1831, now _Crocodylus palustris_ (Lesson), of which Gray's name is now a jr. synonym).

italicus, _Stellio_, Oken, 1816, Lehrb. Naturg. 3: 204 (this work by Oken has been suppressed for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally, and should not be cited in the synonymy of any species).

jacapara, _Coluber_, Houttuyn, 1787, Anim. Mus. Houtt. Index: 26 (this work by Houttuyn has been suppressed for nomenclatural purposes (Opinion 380), hence the name does not exist nomenclaturally: it is also unidentifiable).

lancifer, _Trigonocephalus_, Oken, 1816, Lehrb. Naturg. 3: 270 (this work by Oken has been suppressed for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally, and should not be cited in the synonymy of any species).

leberis, Coluber, Linnaeus, 1758, Syst. Nat., Ed. 10, 1:216 (rejected in priority but not in homonymy contexts to protect Coluber occipitomaculatus Storer, 1839 (now Storeria occipitomaculata (Storer), of which it is now a jr. synonym).

lepidopus, Bipes, Oken, 1816, Lehrb. Naturg. 3: 249 (this work by Oken has been suppressed for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally and should not be cited as a synonym of any species).

lucius, Crocodilus (Alligator), Cuvier, 1807, Ann. Mus. Nat. Hist. Nat. Paris 10: 28 (a jr. synonym of Crocodilus mississippiensis Daudin, 1801, now Alligator mississippiensis (Daudin)).

lutescens, Triturus, Rafinesque-Schmaltz, 1832, Atlantic J. Friend of Knowledge 1: 121 (rejected in priority but not in homonymy contexts to protect Gyrinophilus porphyriticus duryi Weller, 1930, of which it is now a jr. synonym).

marmorata, Amphisbaena, Houttuyn, 1787, Anim. Mus. Houtt. Index: 30 (this work by Houttuyn has been suppressed for nomenclatural purposes (Opinion 380), hence the name does not exist nomenclaturally and should not be cited in the synonymy of any species; it is also unidentifiable).

maxima, Rana, Laurenti, 1768, Specimen Medicum...: 32 (a jr. synonym of Rana boans Linnaeus, 1758, now Hyla boans (Linnaeus)).

melanepis, Coluber, Rafinesque-Schmaltz, 1814, Précis Découv. Trav. Semiolog.: 15 (rejected in priority but not in homonymy contexts to protect Coluber viridiflavus carbonarius Bonnaparte, 1833, now Hemorrhois viridiflava carbonaria (Bonaparte), of which melanepis is now a jr. synonym).

melanocercus, Drymarchon corais, Smith, 1941, J. Washington Acad. Sci. 31: 437, 434 (a jr. objective synonym of Spilotes melanurus Duméril, Bibron and Duméril, 1854, now Drymarchon corais melanurus (Duméril, Bibron and Duméril); originally proposed as a substitute for the latter name, supposed to be invalidated by its senior secondary homonym, Coluber melanurus Schlegel, 1837, via Spilotes melanurus (Schlegel) Gray, 1858).

meleagris, Testudo, Shaw, 1793, Nat. Misc.: tab. 44 (rejected in priority but not in homonymy contexts to protect Cistudo blandingii Holbrook, 1838, now Emydoidea blandingii (Holbrook), of which Shaw's name is now a jr. synonym).

mercurialis, Sphargis, Merrem, 1820, Tent. Syst. Amph.: 19 (a jr. objective synonym of Testudo coriacea Vandelli, 1761, now Dermochelys coriacea (Vandelli)).

michahellesii, Podarcis, Fitzinger, 1864, in Erber, Verh. Zool.-Bot. Ges. Wien, 14: 703 (rejected in priority but not in homonymy contexts to protect Lacerta viridis trilineata Bedriaga, 1886, now L. trilineata (Bedriaga), of which Fitzinger's name is now a jr. synonym).

mildei, Amphisbaena, Peters, 1878, Monatsb. K. Preuss. Akad. Wiss. 1878: 778-781 (rejected in priority but not in homonymy contexts to protect Amphisbaena trachura Cope, 1885, now A. darwini trachura, of which Peters' name is now a jr. synonym).

minor, Testudo mydas, Suckow, 1798, Anfangsgr. Naturg. Thiere 3: 30 (rejected in priority but not in homonymy contexts to protect Thalassochelys (Colpochelys) kempii Garman, 1880, now Lepidochelys kempii (Garman), of which Suckow's name is now a jr. synonym).

mississipiensis, Alligator, Gray, 1831, Syn. Rept.: 62 (an incorrect subsequent spelling of Crocodilus mississippiensis Daudin, 1801, now Alligator mississippiensis (Daudin), without nomenclatural status).

mississipiensis, Crocodilus, Daudin, 1801, Hist. Nat. Rept. 2: 412 (an incorrect original spelling, non-existent nomenclaturally, of Crocodilus mississippiensis Daudin, 1801, now Alligator mississippiensis (Daudin).

mitrata, Rana, Houttuyn, 1787, Anim. Mus. Houtt. Index: 19 (this work by Houttuyn has been suppressed for nomenclatural purposes (Opinion 380), hence the name is nomenclaturally non-existent and should not be assigned to any species; in addition the name is unidentifiable).

molochina, Psammophis, Berthold, 1846, Mitt. Nachr. G.A. Univ. K. Ges. Wiss. Göttingen Zool.Mus. Göttingen 1846: 143, 144 (rejected in priority but not in homonymy contexts to protect Philodryas nattereri Steindachner, 1870, of which Berthold's name is now a jr. synonym).

monitor, Lacerta, Linnaeus, 1758, Syst. Nat., Ed. 10, 1:201 (rejected in priority but not in homonymy contexts to protect Stellio salvator Laurenti, 1768, now Varanus (V.) salvator (Laurenti), of which monitor is now a jr. synonym).

multimaculata, Crotalus lugubris, Jan, 1863, Elenco Sist. Ofidi: 124 (rejected in priority but not in homonymy contexts to

protect Caudisona polysticta Cope, 1865, now Crotalus polystictus (Cope), of which Jan's name is now a jr. synonym).

nasua, Vipera, Wagler, 1830, Natürl. Syst. Amph.: 171 (rejected in priority but not in homonymy contexts to protect Heterodon dorbignyi Duméril, Bibron and Duméril, 1854, now Lystrophis dorbignyi (Duméril, Bibron and Duméril), of which nasua is now a jr. synonym).

neocaesariensis, Proteus, Green, 1818, J. Acad. Nat. Sci. Philadelphia, 1:358 (rejected in priority but not in homonymy contexts to protect Salamandra tigrina Green, 1825, now Ambystoma t. tigrinum (Green), of which Green's name, of 1818, is now a jr. synonym).

niger, Scytale, Daudin, 1803, Hist. Nat. Gén. Partic. Rept.: 342 (based on what is now known as Heterodon platirhinos Latreille, 1801, but rejected in both priority and homonymy contexts, to protect Scytale neuwiedii nigrum Duméril, Bibron and Duméril, 1854, now Pseudoboa nigra (Duméril, Bibron and Duméril); Daudin's name is now non-existent nomenclaturally).

nigricollis, Coluber, Dwigubskij, 1832, Opyt Estestv. Istorii 3:26 (rejected in priority but not in homonymy contexts to protect Coronella modesta Martin, 1838, now Eirenis modesta (Martin), of which Dwigubskij's name is now a jr. synonym).

oaxacae, Kinosternon, Pritchard, 1979, Encycl. Turtles: 557 (rejected in priority but not in homonymy contexts to protect Kinosternon oaxacae Berry and Iverson, 1980, of which Pritchard's name is now a jr. synonym).

ocellata, Lacerta, Houttuyn, 1787, Anim. Mus. Houtt. Index: 24 (this work by Houttuyn has been suppressed for nomenclatural purposes (Opinion 380), hence the name is nomenclaturally non-existent and should not be assigned to any species; in addition the name is unidentifiable).

ocellatus, Draco, Oken, 1816, Lehrb. Naturg. 3:277 (this work by Oken has been suppressed for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally, and should not be cited in the synonymy of any species).

operculata, Siren, Beauvois, 1799, Trans. Am. Philos. Soc. 4:277-281, figs. 1-4 (rejected in priority but not in homonymy contexts to protect Salamandra tigrina Green, 1825, now Ambystoma t. tigrinum (Green), of which Beauvois' name is now a jr. synonym).

oryzicola, Berus, Oken, 1816, Lehrb. Naturg. 3:248 (this work by Oken has been suppressed for nomenclatural purposes (Opinion

417), hence the name does not exist nomenclaturally, and should not be cited in the synonymy of any species).

oryzivorus, Coluber, Suckow, 1798, Anfang. Theor. Angew. Naturg. Thiere 3 Amphibien: 245 (rejected in priority but not in homonymy contexts to protect Boa reticulata Schneider, 1801, now Python reticulatus (Schneider), of which oryzivorus is now a jr. synonym). Op. 1463.

oularsawa, Coluber, Bonnaterre, 1790, Tabl. Encycl. Meth. Trois Regnès Nature: 26 (rejected in priority but not in homonymy contexts, to protect Boa reticulata Schneider, 1801, now Python reticulatus (Schneider), of which oularsawa is now a jr. synonym). Op. 1463.

papillosa, Rana, Houttuyn, 1787, Anim. Mus. Houtt. Index: 19 (this work by Houttuyn has been suppressed for nomenclatural purposes (Opinion 380), hence the name is nomenclaturally non-existent, and should not be assigned to any species; in addition the name is unidentifiable).

pelamys, Hydrophis, Oken, 1816, Lehrb. Naturg. 3: 279 (this work by Oken has been suppressed for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally, and should not be cited in the synonymy of any species).

petrefactus, Crocodilus, Bertrand, 1793, Dict. Univ. Foss. Propres Foss. Accid. 1: 183 (this work by Bertrand has been suppressed for nomenclatural purposes (Opinion 592), hence the name does not exist nomenclaturally, and should not be cited in the synonymy of any species).

philadelphicus, Axolotus, Jarocki, 1822, Zoologiia 3: 179 (rejected in priority but not in homonymy contexts to protect Salamandra tigrina Green, 1825, now Ambystoma t. tigrinum (Green), of which Jarocki's name is now a jr. synonym).

planitia, Testudo, Gmelin, 1789, in Linnaeus, Syst. Nat., ed. 13, 1: 1045 (rejected in priority but not in homonymy contexts to protect Chelonura temminckii Troost, 1835, now Macroclemys temminckii (Troost), of which planitia is now a jr. synonym).

proboscidea, Rhinostoma, Fitzinger, 1826, Neue Classif. Rept.: 56 (confirmed as a nomen nudum, hence non-existent nomenclaturally; originally intended as a name for Heterodon rhinostoma Schlegel, 1837, now Simophis rhinostoma (Schlegel)).

proboscidea, Rhinostoma (Rhinaspis), Fitzinger, 1843, Syst. Rept.: 26 (confirmed as a nomen nudum, hence non-existent nomenclaturally; originally intended as a name for Heterodon rhinostoma Schlegel, 1837, now Simophis rhinostoma (Schlegel)).

punctato-fasciata, _Lacerta_ _muralis_, Eimer, 1881, Arch. Naturg. 47(1): 368, tab. 13, fig. 10 (rejected in priority but not in homonymy contexts to protect _Lacerta_ _muralis_ _neapolitana_ _fiumana_ Werner, 1891, now _Podarcis_ _melisellensis_ _fiumana_ (Werner), of which Eimer's name is now a jr. synonym).

punctato-striata, _Lacerta_ _muralis_, Eimer, 1881, Arch. Naturg. 47(1): 340, tab. 13, figs. 4,5 (rejected in priority but not in homonymy contexts to protect _Lacerta_ _muralis_ _neapolitana_ _fiumana_ Werner, 1891, now _Podarcis_ _melisellensis_ _fiumana_ (Werner), of which Eimer's name is now a jr. synonym).

quater-radiatus, _Coluber_, Gmelin, 1799, Naturforscher 28: 169, tab. 3, fig. 1 (rejected in priority but not in homonymy contexts to protect _Coluber_ _scalaris_ Schinz, 1822, now _Elaphe_ _scalaris_ (Schinz), of which Gmelin's name is now a jr. synonym).

reticulata, _Amphisbaena_, Thunberg, 1787, D.D. Mus. Nat. Acad. Upsaliensis: 30 (rejected in priority but not in homonymy contexts to protect _Amphisbaena_ _cinerea_ Vandelli, 1797, now _Blanus_ _cinereus_ (Vandelli), of which Thunberg's name is now a jr. synonym).

salvaguardia, _Stellio_, Laurenti, 1768, Specimen Medicum: 57 (rejected in priority but not in homonymy contexts to protect _Tupinambis_ _bengalensis_ Daudin, 1802, now _Varanus_ _bengalensis_ (Daudin), of which Laurenti's name is now a jr. synonym).

sclerotica, _Elaphe_, Smith, 1941, Copeia, 1941: 135, 136 (_Coluber_ _subocularis_ Brown, 1901, now _Bogertophis_ _subocularis_ (Brown) ruled not invalidated by the sr. name _Bascanion_ _suboculare_ Cope, 1867, a jr. synonym of _Masticophis_ _m_. _mentovarius_ (Duméril, Bibron and Duméril, 1854), hence Smith's name is a jr. objective synonym of Brown's name).

semimembranacea, _Testudo_, Hermann, 1804, Observ. Zool.: 219 (rejected in priority but not in homonymy contexts to protect _Trionyx_ (_Aspidonectes_) _sinensis_ Wiegmann, 1835, now _Trionyx_ _sinensis_ Wiegmann, of which Hermann's name is now a jr. synonym).

sumichrasti, _Henicognathus_, Bocourt, 1886, Miss. Sci. Mex. (10): 628-630, pl. 41, fig. 5. (rejected in priority but not in homonymy contexts to protect _Ablabes_ _chinensis_ Günther, 1889, now _Sibynophis_ _chinensis_ (Günther), of which Bocourt's name is now a jr. synonym).

terrestris, _Testudo_, Fermin, 1765, Hist. Nat. Hollande Equinox.: 51 (this work by Fermin has been suppressed for nomenclatural

purposes (Opinion 660), hence the name does not exist nomenclaturally, and should not be cited in the synonymy of any species).

tibiatrix, Hyla, Laurenti, 1768, Spec. Medicum: 34 (rejected in priority but not in homonymy contexts to protect Rana venulosa Laurenti, 1768, now Phrynohyas venulosa (Laurenti), of which H. tibiatrix is now a jr. synonym).

timorensis, Python, Müller, 1844, Verh. Natuurl. Gesch. Ned. Overz. Bez., Land- en Volkenk. (7): 211, 221 (rejected in priority but not in homonymy contexts to protect Liasis mackloti Duméril and Bibron, 1844, of which Müller's name is now a jr. synonym).

timoriensis, Python, Müller, 1857, Reizen en Onderzoekingen in den Indischen Archipel, gedaan op last der Nederlandsche Indische Regeering, tusschen de Jaren 1828 en 1836 2: 172 (ruled an incorrect subsequent spelling of Python timorensis Müller, 1844, hence without nomenclatural status).

trimeresurus, Coluber dipsas, Oken, 1816, Lehrb. Naturg. 3:263 (this work by Oken has been suppressed for nomenclatural purposes (Opinion 417), hence the name does not exist nomenclaturally, and should not be cited in the synonymy of any species).

unicolor, Cornufer, Tschudi, 1838, Class. Batr.: 28 (Tschudi's usage, and all others prior to the proposal of Eleutherodactylus unicolor Stejneger, 1904, are rejected in both priority and homonymy contexts, to preserve Stejneger's name, which would otherwise be a jr. homonym; Tschudi's name is actually referable to Eleutherodactylus and would, if not rejected, replace Leptodactylus inoptatus Barbour, 1914, now E. inoptatus (Barbour); Tschudi's name, as type of Cornufer, requires replacement in that role to leave the name Cornufer as long interpreted, through designation of Halophila vitiensis Girard, 1853, as type species, although that species is now generally referred to the genus Platymantis Günther, 1858, along with all other species formerly referred to Cornufer; if Platymantis is split in the future, Cornufer is available if needed; thus three names are protected by rejection of Tschudi's name).

ventricosa, Emys, Gray, 1855, Cat. Shield Rept. Coll. Brit. Mus., Pt. I, Testudinata (Tortoises): 28, pl. 14 (rejected in priority but not in homonymy contexts to protect Emys cataspila Günther, 1885, now Trachemys ornata cataspila (Günther), of which Gray's name is now a jr. synonym).

verrucosa, Rana, Houttuyn, 1787, Anim. Mus. Houtt. Index: 19 (this work by Houttuyn has been suppressed for nomenclatural purposes (Opinion 380), hence the name is nomenclaturally non-existent and should not be assigned to any species; in addition the name is unidentifiable).

vertebralis, Leptophis, Duméril, Bibron and Duméril, 1854, Erp. Gen. 7: 543, 544 (rejected in priority but not in homonymy contexts to protect Natrix barbouri Taylor, 1922, now Macropophis barbouri (Taylor), of which L. vertebralis is now a jr. synonym).

viridi-squamosa, Testudo, Lacépède, 1788, Hist. Nat. Quad. Ovip. Serpens 1, Syn. Meth.: 92 (rejected in priority but not in homonymy contexts to protect Thalassochelys (Colpochelys) kempii Garman, 1880, now Lepidochelys kempii (Garman), of which Lacépède's name is now a jr. synonym).

zonata, Hyla, Spix, 1824, Anim. Nov. Test. Ran. Brasil: 41 (ruled a jr. objective synonym of Rana venulosa Laurenti, 1768, [now Phrynohyas venulosa (Laurenti)], through action of the ICZN under its plenary powers).

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CROSS-INDEXES

The following cross-indexes will facilitate scanning the 200 names here treated for those pertinent to valid names. The list is divided into two groups: nomina clara (names whose allocation to known taxa is apparent) and nomina dubia (names whose allocation to any given taxon is uncertain).

NOMINA CLARA

Indented names are to be found in the preceding account. CAUTION: not all indented names are synonyms of the valid names under which they appear; most are, but in some cases the valid name is simply discussed in the account for the invalid name.

CAUDATA

A. Family-Group Names

Ambystomatidae
    Ambystomidae

B. Genus-group Names

Ambystoma
    Amblystoma
    Axolot
    Axolotus
    Philhydrus
    Phyllhydrus
    Siredon
    Sirenodon

Stegoporus
Andrias
Palaeotriton
Proteocordylus
Aneides
Anaides
Autodax
Bolitoglossa
Oedipus
Palmatotriton
Notophthalmus
Diemichylus
Diemyctelus
Diemyctylus
Notophthalma
Notophthalmia
Notopthalmus
Siren
Sirena
Sirene

C. Species-group Names

Ambystoma tigrinum tigrinum
neocaesariensis, Proteus
operculata, Siren
philadelphicus, Axolotus
Aneides lugubris
ereticauda, Triton
Cryptobranchus alleganiensis
alleghaniensis, Abranchus
Gyrinophilus porphyriticus duryi
lutescens, Triturus
Plethodon cinereus
erythronota, Salamandra
Pleurodeles waltl
funebris, Salamandra

SALIENTIA

A. Family-group Names

Leiopelmatidae
Leiopelmidae
Liopelmatina
Liopelmidae

B. Genus-group Names

Kassina
Eremiophilus
Leiopelma
Liopelma
Phrynohyas

Acrodytes
Syrrhophus
Epirhexis

C. Species-group Names

Eleutherodactylus inoptatus
unicolor, Cornufer
Eleutherodactylus unicolor
unicolor, Cornufer
Hyla boans
maxima, Rana
Phrynohyas venulosa
tibiatrix, Hyla
zonata, Hyla
Platymantis vitiensis
unicolor, Cornufer
Rana grayi
fasciata, Rana
Rana perezi
bosci, Rana

GYMNOPHIONA

A. Family-group Names

Caeciliaidae
Caeciliidae
Cecilinia

RHYNCHOCEPHALIA

A. Family-group Names

Sphenodontidae
Hatteriidae
Rhynchocephalidae

B. Genus-group Names

Sphenodon
Hatteria
Rhynchocephalus
Sphaenodon

TESTUDINES

A. Genus-group Names

Dermochelys
Coriudo
Dermatochelys
Dermochelis
Sphargis

Rhinoclemmys
    Chemelys

B. Species-group Names

Dermochelys coriacea
    mercurialis, Sphargis
Emydoidea blandingii
    flava, Testudo
    meleagris, Testudo
Kinosternon alamosae
    alamose, Kinosternon
Kinosternon oaxacae
    oaxacae, Kinosternon
Lepidochelys kempii
    minor, Testudo mydas
    viridi-squamosa, Testudo
Macroclemys temminckii
    planitia, Testudo
Rhinoclemmys punctularia
    dorsata, Testudo
Trachemys ornata cataspila
    ventricosa, Emys
Trionyx sinensis
    semimembranacea, Testudo
Trionyx steindachneri
    californiana, Aspidonectes

SAURIA

A. Family-group Names

Agamidae
    Agamoidea
    Stellionidae (2)
Teiidae
    Tupinambidae

B. Genus-group Names

Agama
    Stellio
Bachia
    Brachypus
Chalarodon
    Tritropis
    Tropidogaster
Draco
    Dracunculus
Ichnotropis
    Thermophilus
Mabuya
    Mabouia
    Mabouya

Mabuia
Mabuya
Phrynosoma
Tapaia (2)
Tapaja
Tapaya (2)
Tapayia
Uromastyx
Centrocercus

C. Species-group Names

Agama agama agama
colonorum, Agama
Agama bibronii
bibronii, Trapelus (Psammorrhoa)
Anguis fragilis colchica
besseri, Anguis
Bachia bicolor
diglossis, Chirotes
Chalarodon madagascariensis
blainvillii, Tropidogaster
Lacerta trilineata
michahellesii, Podarcis
Podarcis melisellensis fiumana
punctato-fasciata, Lacerta muralis
punctato-striata, Lacerta muralis
Varanus bengalensis
dracaena, Lacerta
salvaquardia, Stellio
Varanus (Varanus) salvator
monitor, Lacerta

AMPHISBAENIA
A. Species-group Names

Amphisbaena darwini trachura
mildei, Amphisbaena
Amphisbaena dubia
dubia, Amphisbaena
Amphisbaena fuliginosa amazonica
dubia, Amphisbaena
Blanus cinereus cinereus
reticulata, Amphisbaena

SERPENTES
A. Genus-group Names

Ahaetulla
Dryinus
Dryophis
Passerita

Anilius
    Tortrix
Bitis
    Cobra
Boa
    Constrictor
Boiga
    Ibiba
Cemophora
    Amplycephalus
Clonophis
    Cora
Dasypeltis
    Anodon
Dendrelaphis
    Tachyophis
Dromophis
    Philodendros
    Philodendrus
Enhydris
    Enhydrus
Leptophis
    Ahaetulla
    Dendrophis
Leptotyphlops
    Typhlina
Lystrophis
    Rhinostoma
Ophidioniscus
    Ophidion
Ophiophagus
    Dendraspis
    Hamadryas
Pareas
    Amplycephalus
Phimophis
    Rhinosimus
Sibon
    Asthenognathus
Simophis
    Rhinaspis
Spalerosophis
    Sphalerosophis

B. Species-group Names

Boa constrictor
    formosissimus, Constrictor
Bogertophis subocularis
    sclerotica, Elaphe
Cemophora coccinea
    doliatus, Coluber
Crotalus atrox
    cinereous, Crotalus

Crotalus horridus
    cincolor, Crotalus durissus
    concolor, Crotalus durissus
Crotalus polystictus
    multimaculata, Crotalus lugubris
Crotalus viridis decolor
    concolor, Crotalus durissus
Drymarchon corais melanurus
    melanocercus, Drymarchon corais
Drymobius margaritiferus
    chiametla, Coluber
Drymobius margaritiferus fistulosus
    chiametla, Coluber
Eirenis modesta
    nigricollis, Coluber
Elaphe scalaris
    elaphis, Coluber
    quater-radiatus, Coluber
Hemorrhois viridiflava carbonaria
    melanepis, Coluber
Heterodon platirhinos
    niger, Scytale
Liasis mackloti
    timorensis, Python
    timoriensis, Python
Lystrophis dorbignyi
    nasua, Vipera
Macropophis barbouri
    vertebralis, Leptophis
Ninia atrata
    atratus, Coluber
Philodryas nattereri
    molochina, Psammophis
Philothamnus irregularis
    caesius, Coluber
Psammophis subtaeniata
    bilineatus, Psammophis moniliger
Pseudoboa nigra
    niger, Scytale
Python reticulatus
    oryzivorus, Coluber
    oularsawa, Coluber
Sibynophis chinensis
    sumichrasti, Henicognathus
Simophis rhinostoma
    proboscidea, Rhinostoma
    proboscidea, Rhinostoma (Rhinaspis)
Storeria occipitomaculata
    leberis, Coluber
Vipera ursinii renardi
    foetidus, Coluber

CROCODYLIA
A. Species-group Names

Alligator mississippiensis
  alligator, Lacerta
  lucius, Crocodilus (Alligator)
  mississipiensis, Alligator
  mississipiensis, Crocodilus
Crocodylus palustris
  indicus, Crocodilus vulgaris

NOMINA DUBIA

A few of the invalid names listed in the preceding section are nomenclaturally non-existent, but are included there because they have commonly been included in synonymies. Thirty-seven other names, not commonly cited in synonymies, and non-existent nomenclaturally (hence not obliged to be cited), follow, with author and date.

SALIENTIA

Bufo cruciger Oken, 1816
Rana coerulea Houttuyn, 1787
Rana mitrata Houttuyn, 1787
Rana papillosa Houttuyn, 1787
Rana verrucosa Houttuyn, 1787

TESTUDINES

Testudo terrestris Fermin, 1765

SAURIA

Discosomus Oken, 1816
Petrodactylus Oken, 1816
Pterodactylus Oken, 1816
Scinci Oken, 1816
Scincorum Oken, 1816
Zygnis Oken, 1816
Anguis granulatus Houttuyn, 1787
Bipes lepidopus Oken, 1816
Draco ocellatus Oken, 1816
Lacerta areolata Houttuyn, 1787
Lacerta fasciata Houttuyn, 1787
Lacerta grisea Oken, 1816

Lacerta ocellata Oken, 1816
Scincus galliwasp Oken, 1816
Stellio graecus Oken, 1816
Stellio italicus Oken, 1816

AMPHISBAENIA

Propus Oken, 1816
Amphisbaena flavescens Houttuyn, 1787
Amphisbaena marmorata Houttuyn, 1787

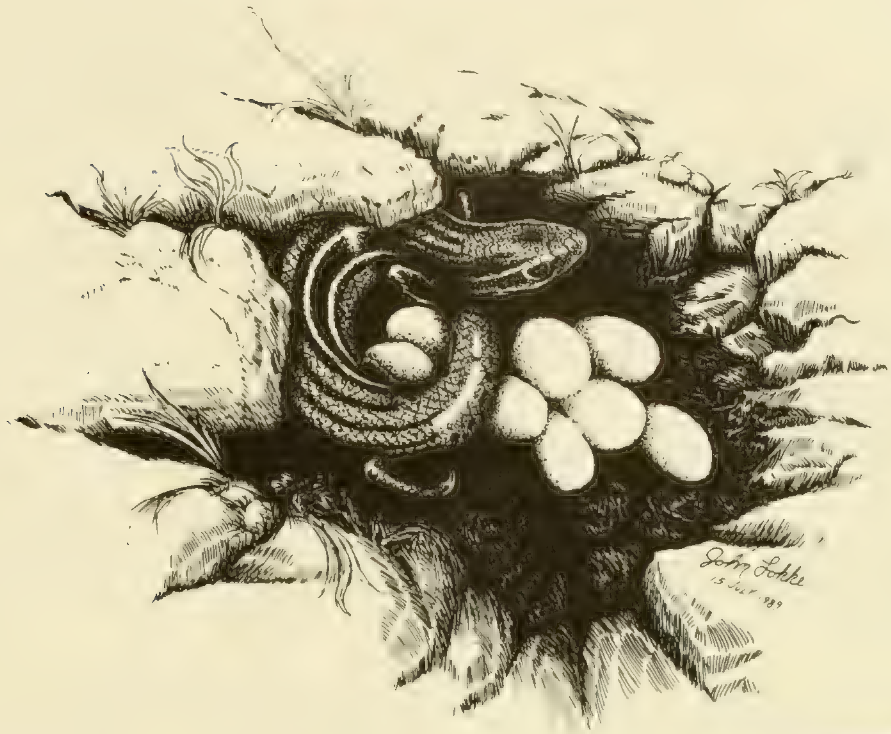
SERPENTES

Berus Oken, 1816
Draco Oken, 1816
Herpeton Oken, 1816
Berus oryzicola Oken, 1816
Coluber cupreus Houttuyn, 1787
Coluber dipsas trimeresurus Oken, 1816
Coluber jacapara Houttuyn, 1787
Crotalus durissus concolor Jan, 1859
Hydrophis pelamys Oken, 1816
Trigonocephalus lancifer Oken, 1816

CROCODYLIA

Crocodilus Bertrand, 1763
Crocodilus petrefactus Bertrand, 1763

A CATEGORIZATION AND BIBLIOGRAPHIC SURVEY OF PARENTAL BEHAVIOR IN LEPIDOSAURIAN REPTILES



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INTRODUCTION

Parental behavior is a significant aspect of the life history of a wide variety of animal taxa. Parental behavior is common to the vertebrate classes Osteichthyes (Blumer, 1979, 1982; Perrone and Zaret, 1979; Baylis, 1981; Gittleman, 1981; Gross and Sargent, 1985), Amphibia (McDiarmid, 1978; Wells, 1981; Nussbaum, 1985; Duellman and Trueb, 1986), and universal within the Aves (Kendeigh, 1952; Skutch, 1957, 1976; Welty, 1982; Silver et al., 1985) and Mammalia (Kleiman and Malcolm, 1981; Dewsbury, 1985; Kleiman, 1985; Malcolm, 1985). In contrast, relatively few reptiles exhibit parental behavior (Tinkle and Gibbons, 1977; Shine and Bull, 1979; Shine, 1985, 1988). Parental behavior is common in living crocodilians (Greer, 1970, 1971; Lang, 1987; Shine, 1988) and also may have been common in extinct archosaurs (Horner and Makela, 1979; Coombs, 1982; Horner, 1982, 1984, 1987; Horner and Gorman, 1988) and cynodonts (Graves and Duvall, 1983; Duvall, 1986). Accounts of parental behavior in four turtle species (*Gopherus agassizii*: Barrett and Humphrey, 1986; *G. flavomarginatus*: Carr, 1952; Janulaw and Appleton cited in Morafka, 1982; Appleton, 1986; Ernst and Barbour, 1989; *Manouria emys*: Louwman, 1982; McKeown et al., 1982; *Trachemys stejnegeri malonei*: Hodsdon and Pearson, 1943) are remarkable, because turtles generally lack any form of parental behavior (Shine, 1988; Ernst and Barbour, 1989). The purpose of this review is to survey the various categories of parental behavior reported for lepidosaurians (lizards, snakes, amphisbaenians and a rhychocephalian) and to provide an extensive bibliography as a guide to current and future researchers.

The phrase "parental care" refers to all nongametic and postfertilization contributions of parents to the survival of their offsprings (Wittenburger, 1981; Blumer, 1982) and is construed by some (Williams, 1966; Baylis, 1981; Keenleyside, 1981; Gross and Sargent, 1985; Congdon, 1989; Spotila and O'Connor, 1989) to include viviparity and other physiological contributions. I use the phrase "parental behavior" to limit the scope of this survey to all *behavioral* contributions by the parent to offspring survival after oviposition or parturition. Behaviors associated exclusively with oviposition and nest construction are not included in this survey; they are probably common to most oviparous lepidosaurians (Hahn, 1909; Hilzheimer, 1910; Blanchard, 1933; Carl, 1944; Carpenter, 1966; Platt, 1969; Rand and Rand, 1976; Duvall et al., 1979; Jones and Guillette, 1982; Green and Pauley, 1987).

The term "brooding" describes behaviors of the parent while attending the nest and progeny (sensu Somma, 1988; also see Pope, 1961; Peters, 1964; Carpenter and Ferguson, 1977). Thus, brooding does not include territorial, nest-site defense wherein the parent remains at a distance from the nest, and not in or on the nest or progeny, as seen in some iguanine and gekkonid lizards, and the tuatara.

HISTORICAL ASPECTS

The oldest conceivable documentation of parental behavior in a lepidosaurian is in the book of Isaiah, 34:15 (McDowell et al., 1982) written some time between 745-350 BC (Asimov, 1968). In this account, the Hebrew word "lilith," at one time interpreted as an owl (Strong, 1961; Asimov, 1968), is referred to as the "arrow snake." This vernacular name may have referred to the boid Eryx jaculus (Topsell, 1608; White, 1954). Since E. jaculus is viviparous, the snake reputed to "lay eggs and hatch, and gather them under her shadow" (McDowell et al., 1982) may refer to an oviparous snake or be erroneous, if not simply a fable.

Much of the pre-Twentieth century natural history literature indicates that many authors believed parental behavior was universal in snakes (Aristotle, [d. 322 BC]; Nicander of Colophon [135-133? BC]; Gesneri, 1551-1587; Topsell, 1608; Chateaubriand, 1827; Sundowner, 1895, 1902). The Second Voyage of Sinbad the Seaman, written in the 8th century AD (Burton, 1885-1888), is an example of early fiction that mentions a giant snake (undoubtedly a python) brooding its eggs. The "cockatrice" or "basilisk" was reputed to brood her eggs (Gesneri, 1551-1587; Topsell, 1608). It is likely that this mythical beast was a fantastical description of a cobra, either Ophiophagus hannah or a species of Naja (White, 1954; also see descriptions by Pliny the Elder, [d. AD 79]; Gesneri, 1551-1587; Topsell, 1608). Similarly, brooding was attributed to the "asp" (= Naja haje?) and the "dipsas" (= Bungarus sp.?; White, 1954) by Nicander. Modern documentation confirms that these taxa brood their eggs (Table VI).

Snakes have long been credited with the ability to swallow their young to protect them from danger (Topsell, 1608; Carver, 1778; Mease, 1807; Holmes, 1823; Hunter, 1824; Chateaubriand, 1827; Gosse, 1851; Rivers, 1874; Stanley, [19??]; Burroughs, 1908; Meek, 1946). Earliest accounts of this behavior are found in hieroglyphics attributed to the ancient Egyptians circa 2300 BC (Speck, 1923). So prevalent was (and still is!) this belief, that it was incorporated into early fiction, including the pre-Elizabethian poem, The Faerie Queene (Spenser, 1590). This alleged behavior, attributed not only to snakes but also to the lizard, Lacerta vivipara (Hopley, 1882), has been reviewed and discussed by numerous authors for more than 300 years (Browne, 1646; White, 1787; Hopley, 1882; Noble, 1921; Speck, 1921, 1923; Schmidt, 1929; Ditmars and Bridges, 1937; Angel, 1950; Klauber, 1972; Russell, 1983; Shine, 1988). Despite many inquiries into the plausibility of this behavior, no scientific evidence exists for its occurrence (Klauber, 1972; Shine, 1988).

Among saurians, Scincus scincus was reputed to care for its eggs and young (Gesneri, 1551-1587; Topsell, 1608), but no modern observations support this contention (Table V). Hoy (1883) suggested that all lizards brooded their eggs. In all likelihood, his statement is based upon observations of Ophisaurus attenuatus and Eumeces septentrionalis; these are the only egg-brooding lizards that he actually observed (Hoy, 1883). The suggestion that an amphisbaenian broods its eggs (Gesneri, 1551-1587; Topsell, 1608; Aldrovandi, 1640; reviewed in Druce, 1910), has not been verified.

CATEGORIES OF PARENTAL BEHAVIOR

The various categories of parental behavior, as reported in the literature, are listed below. The symbol in parentheses identifies the categories used in Tables I and II. The literature sources are provided in Tables V and VI.

Coil around brood (C): The attendant parent remains coiled around or covers the brood with its body, presumably creating a physical buffer or barrier between progeny and the external environment. This is the most common form of parental behavior.

Nest constructed and maintained (NC): A burrow or brood chamber is constructed by the parent and maintained while attending progeny. Although this usually involves digging a depression or burrow in the substrate, _Ophiophagus hannah_ is known to maintain a relatively complex nest chamber constructed from surrounding vegetation (Wasey, 1892; Oliver,1956; Leakey, 1969; Whitaker, 1977).

Defense of brood (D): Progeny are aggressively defended by parent in the presence of conspecifics or heterospecifics.

Passive protection (PP): Neonatal vipers may accrue protection from the venomous female, without her exhibiting any overt signs of aggressive behavior (i.e., _Crotalus horridus_: W. Martin, pers. comm.).

Thermoregulation (T): Attendant parent uses its body to maintain a relatively constant incubation temperature for developing eggs. Most, perhaps all, pythonines are able to become low-grade endotherms while brooding through "shivering thermogenesis," thereby raising the temperature of the female's body and developing eggs above that of ambient conditions (Vinegar et al., 1970; Harlow and Grigg, 1984; Shine, 1988). However, it has been suggested that shivering thermogenesis is not practiced by all species of pythons (Vinegar et al., 1970; Ellis and Chappell, 1987; but see [Orlov], 1986; Shine, 1988). It is also possible that an attendant parent could (1) provide a passive thermal barrier between eggs and the external environment with its body or (2) bask in the sun and transfer radiantly absorbed heat from its body to its eggs (Medsger, 1919, 1932; Noble and Mason, 1933; Cogger and Holmes, 1960). Python eggs, of at least two species, that are not brooded, and subsequently incubated at lower temperatures, take longer to hatch and exhibit a higher rate of developmental anomalies (Vinegar, 1973, 1974; Branch and Patterson, 1975).

Hydroregulation (H): Even though is has never been demonstrated experimentally, hydroregulation has been inferred from some squamates (Fitch, 1954; Somma, 1985_b_; Bels and Van den Sande, 1986; [Orlov], 1986; York and Burghardt, 1988; Somma, 1989_b_; Somma and Fawcett, 1989). In addition, tenuous evidence suggests that two species of snakes wet their bodies with water and then lay over the eggs, thereby reducing desiccation (_Elaphe obsoleta_: J. Lombard, pers. comm.; _Trimeresurus wiroti_: Mehrtens, 1987).

False brooding (FB): Many species of pythons continue to brood when their clutches are removed prior to hatching (T. Miller, pers. comm.), and a Python molurus has brooded without ovipositing (J. S. Foster, pers. comm.). The nongravid female P. m. bivittatus housed with two gravid conspecifics brooded when the gravid females oviposited and brooded their eggs. This "false brooding" consisted of the python laying in a conical coil and exhibiting shivering thermogenesis (J. S. Foster, pers. comm.; Somma, pers. observ.).

Oophagy (OO): The parent eats eggs or aborted ova. This is a form of parental behavior because it may prevent microbial infection of viable, healthy eggs from adjacent infected eggs (Groves, 1982; Somma, 1989a) or prevent detection of progeny by predators using olfaction (i.e., detection of chemical cues released from rotting eggs or aborted ova) to locate food (Tinkle and Gibbons, 1977; Groves, 1982; Shine, 1988). Earliest observations of this behavior may be found in Hindu scriptures dating back to 600 BC (Rao, 1957).

Removal of nonviable eggs from nest (RE): Nonviable eggs are removed from the nest, presumably at a safe distance from viable eggs. This behavior has been reported only in Python molurus (Griehl, 1982) and perhaps occurs in Gerrhonotus liocephalus (Greene cited in Tinkle and Gibbons, 1977).

Parental care of neonates (CN): A parent remains with and expresses parental behavior toward neonates after hatching or parturition.

Neonates assisted during hatching or parturition (AN): Attending parent assists neonates from eggs, extraembryonic membranes or nest chamber. In Eumeces obsoletus and E. septentrionalis, the mother licks amniotic fluid from neonates' bodies after hatching (Evans, 1959; Somma, 1987c).

Manipulation or retrieval of eggs (ME): Eggs are manipulated within the nest or moved to a new nest site. Eggs that have been removed from the nest may also be retrieved.

Communal care of eggs (CC): Eggs may be deposited in a communal clutch and attended by several unrelated parents. In some situations, this behavior could be interpreted as alloparental care (Banks and Schwaner, 1984; Somma, 1987a).

Neonatal feeding facilitated (FN): A brooding female E. obsoletus avoided taking food items in deference to its young, waiting for them to finish before she fed (Evans, 1959). This behavior has not been observed in other reptiles.

Normally does not exhibit parental behavior (NPB): Parental behavior has been reported (sometimes reliably) for individuals of species that normally abandon their progeny.

Details unknown (DU): Details of parental behavior are not known or not reported.

Reliability uncertain (RU): Reliability of report regarded as uncertain or possibly unreliable due to paucity of information provided or observed by the author.

Erroneous documentation (E): Report considered unsubstantiated due to inadequate information for a species normally lacking parental behavior.

DISCUSSION

Over 6140 extant species of lepidosaurian reptiles are currently recognized (Bellairs, 1986); of these, parental behavior has been reported for 210 species. Only 148 species (82 lizards, 65 snakes, and Sphenodon) are represented by reliable documentation or approximately 2.4% of all lepidosaurians (Table III). These species represent 17 families, excluding the unsubstantiated documentation for the Hydrophiidae, Typhlopidae and the unidentified amphisbaenid family (Tables I, II, III). Parental behavior is common in Eumeces, Phelsuma, Uromastix, anguids, xantusiids, iguanines, oviparous boids, southeast-Asian elapids, oviparous viperids, Elaphe, Farancia, and Psammophylax (Tables I and II). In most species (96%) parental behavior is entirely maternal; however, paternal and biparental behavior have been confirmed (Table IV).

The literature in this survey (Tables V and VI) demonstrates a paucity of experimentally obtained data on parental behavior in lepidosaurians (but see Noble and Mason, 1933; Hutchison et al., 1966; Vinegar et al., 1970; Van Mierop and Barnard, 1976a, 1978; Hasegawa, 1985, Somma, 1985b; [Orlov], 1986; Ellis and Chappell, 1987; York and Burghardt, 1988; Graves, 1989; Somma and Fawcett, 1989; Vitt and Cooper, 1989; Guillette et al., in review). The majority of the literature is descriptive or anecdotal, and the adaptive functions of this life history trait remain largely conjectural. Furthermore, the only ecological/evolutionary analysis devoted solely to parental behavior in reptiles is provided by Shine (1988; see Lillywhite, 1988).

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The cover illustration depicts a female Eumeces s. septentrionalis from Nebraska brooding eggs. I thank John F. Lokke for creating the original artwork from which the illustration was copied.

TABLE I

Distribution of parental behavior in lizards, amphisbaenians and a rhynchocephalian

Taxa	Type of parental behavior	Oviparous or viviparous	Maternal, paternal or biparental
Agamidae			
Leiolepis belliana	RU, CN	O	B?
Phrynocephalus sp.	RU, CN	O	B
Uromastix aegyptius	D	O	M
U. ornatus	D, CN	O	M
Anguidae			
Barisia imbricata	AN	V	M
Diploglossus bilobatus	C	O	M
D. delasagra	C	O	P
Elgaria coerulea	AN	V	M
E. multicarinata	C, NC, D, CC	O	M
Gerrhonotus liocephalus	C, OO?, RE?	O	M
Mesaspis moreleti	AN	V	M
Ophisaurus apodus	C, D	O	M
O. attenuatus	C, OO	O	M
O. compressus	C	O	M
O. gracilis	C	O	M
O. harti	C	O	M
O. ventralis	C, ME, OO	O	M
Cordylidae			
Cordylus cataphractus	CN	V	B
C. giganteus	CN	V	M
Gekkonidae			
Ailuronyx seychellensis	C, D, OO, AN?	O	M
Chondrodactylus angulifer	RU, D?	O	M
Eublepharis macularis	RU, D, NPB	O	M
Gekko gecko	C, D, NPB?	O	M, P
G. petricolus	C, D, OO	O	M, P
G. smithii	RU, DU	O	M

Hemidactylus turcicus	D, NPB?	O	M
Hemiphyllodactylus typus	RU, DU	O	M
Naultinus grayi	CN, D	V	B
Phelsuma borbonica	D	O	M
P. dubia	D, OO	O	M
P. flavigularis	D, OO	O	M
P. lineata	D, OO	O	M
P. madagascariensis	D, OO	O	M
P. standingi	ME	O	M
Phyllodactylus lanei	C, CC	O	M
Ptychozoon lionotum	C, D	O	M
Teratoscincus scincus	RU, NPB?	O	M
Iguanidae			
Amblyrhynchus cristatus	D	O	M
Brachylophus fasciatus	D	O	M
B. vitiensis	D	O	M
Conolophus pallidus	D	O	M
C. subcristatus	D	O	M
Crotaphytus collaris	RU, NPB	O	M
Cyclura carinata	D	O	M
C. cornuta	D	O	M
C. cychlura	D	O	M
C. nubila	D	O	M
Iguana iguana	D	O	M
Phrynosoma douglassi	RU, D, NPB	V	M
Sauromalus varius	D	O	M
Sceloporus undulatus	E, CN	O	B
Lacertidae			
Acanthodactylus scutellatus	RU, CN	O	M
Lacerta viridis	D?, ME	O	M
Scincidae			
Calyptotis scutirostrum	ME, NC	O	M
Corucia zebrata	CN, D, AN?	V	M
Cyclodina pseudornata	AN	V	M
Egernia cunninghami	AN, D	V	M
E. striata	RU, CN	V	M
E. whitii	RU, CN	V	?
Emoia cyanura	RU, CC?	O	M
Eumeces anthracinus	C, D, NC, OO	O	M
E. callicephalus	C, OO, NC, ME	O, V*	M
E. chinensis	C, NC	O	M
E. copei	CN	V	M
E. egregius	C, D, NC, CC	O	M
E. elegans	C	O	M
E. fasciatus	CN, C, D, ME, NC, OO, H?, CC	O	M
E. inexpectatus	C, OO, CC	O	M
E. laticeps	C, D, NC, ME, OO, CN,CC	O	M
E. latiscutatus	C, CN	O	M
E. lynxe	CN	V	M
E. multivirgatus	C, CN?, CC	O	M
E. obsoletus	C, ME, NC, CN, FN, D, OO	O	M

E. okadae	C, NC, OO, ME, CC	O	M
E. oshimensis	DU	O	M
E. parviauriculatus	CN	O	M
E. quadrilineatus	DU	O	M
E. schneiderii	C	O	M
E. septentrionalis	C, D, NC, H, ME, CN, CC, OO, AN	O	M
E. skiltonianus	C, D, NC, ME, CN?	O	M
E. stimsoni	RU, DU	O	M
E. tetragrammus	C	O	M
E. xanthi	C	O	M
Lampropholis mustelina	ME, NC	O	M
Leiolopisma otagense	AN	V	M
L. smithi	AN	V	M
L. zia	ME, NC	O	M
Mabuya capensis	AN	V	M
M. macrorhyncha	AN	V	M
M. macularia	RU, DU	O	M
Neoseps reynoldsi	C	O	M
Scincus scincus	E?, CN	O	M
Sphenomorphus quoyii	AN	V	M
Tiliqua rugosa	AN	V	M
Teiidae			
Tupinambis teguixin	C, D, CN?, NC, AN?	O	M
T. rufescens	NC, D?	O	M
Varanidae			
Varanus gouldii	E, AN	O	?
V. griseus	RU, DU	O	M
V. komodoensis	RU, AN, NPB?	O	M
V. mitchelli	RU, C	O	M
V. salvator	RU, D?, NPB	O	M
V. varius	AN	O	M
Xantusiidae			
Xantusia henshawi	AN	V	M
X. vigilis	AN	V	M
Trogonophidae or Amphisbaenidae (?)			
`Amphisbaina' (= unidentified species)	RU, C	O	M
Sphenodontidae			
Sphenodon punctatus	D	O	M

*One instance of viviparity in E. callicephalus has been reported by Taylor (1985).

TABLE II

Distribution of parental behavior in snakes

Taxa	Type of parental behavior	Oviparous or viviparous	Maternal, paternal or biparental
Boidae			
Aspidites melanocephalus	C, T	O	M
Boa constrictor	RU, C, D, NPB	V	M
Casarea dussemieri	RU, C	O	M
Chondropython viridis	C, T, D, H	O	M
Epicrates cenchria	AN, OO, D, CN	V	M
E. striatus	OO	V	M
E. subflavus	E, C	V*	M
Eunectes murinus	AN, OO	V	M
E. notaeus	AN, OO	V	M
Liasis albertisii	C, D, T	O	M
L. boa	C	O	M
L. childreni	C	O	M
L. fuscus	C, T, D, H	O	M
L. olivaceus	C	O	M
L. papuanus	C, T	O	M
L. perthensis	C	O	M
Morelia amethistina	C, T, CC	O	M
M. bredli	C	O	M
M. spilota	C, T, H, D, NC	O	M
Python anchietae	C, T	O	M
P. curtus	C, T	O	M
P. molurus	C, T, D, FB, RE, CN?, H?, ME	O	M
P. regius	C, T, D, H, ME	O+	M
P. reticulatus	C, T?, D	O	M
P. sebae	C, T?, D, ME, RE	O	M
P. timoriensis	C, T	O	M
\`Lilith'or\`arrow snake' (= Eryx jaculus?)	E?, C	V	M
Colubridae			
Ahaetulla nasuta	OO	V	M
Amphiesma stolata	C	O	M
Atretium schistosum	RU, C	O	M
Cemophora coccinea	E, C, OO	O	M
Cerberus rynchops	RU, CN	V	M
Clelia clelia	C, H?	O	M
Coronella austriaca	RU, CN	V	M
Diadophis punctatus	C, NPB, CC?	O	M
Elaphe climacophora	C	O	M
E. flavolineata	C	O	M
E. guttata	RU, C, NPB	O	M
E. obsoleta	C, D, H?, NPB, CC?	O	M, B?
E. quadrivirgata	C, D	O	M
E. quatuorlineata	RU, C, NPB	O	M
E. schrenki	RU, C	O	M

Farancia abacura	C, NC, CN?	O	M
F. erytrogramma	RU, C	O	M
Heterodon platirhinos	E, C, D	O	M
Hydrodynastes gigas	RU, C	O	M
Lampropeltis triangulum	RU**, C, NPB	O	M
Lycodon aulicus	RU, C	O	M
L. striatus	RU, C	O	M
Masticophus flagellum	E, CN	O	B
Natrix natrix	C, D, NPB	O	M
Oligodon taeniolatus	RU, C	O	M
Opisthotropis latouchii	C, H?	O	M
Pituophis catenifer	E, C, D	O	M
Psammophylax rhombeatus	C, CC	O	M
P. tritaeniatus	C	O	M
P. variabilis	C	O (V)	M
Ptyas korros	RU, C	O	M
P. mucosus	C	O	M
Rhabdophis subminiata	C	O	M
Sinonatrix percarinata	C	O	M
Tropidonophis mairii	C	O	M
Xenochrophis piscator	C, NC	O	M
Elapidae			
Bungarus caeruleus	C	O	M
B. candidus	C	O	M
B. ceylonicus	C, CC?, NC, CN?	O	B?
B. fasciatus	C, CN?	O	M, B?
'Dipsas' (= Bungarus sp.?)	RU, CN?	O	M
Calliophis maculiceps	RU, D?	O	M
Demansia papuensis	RU, DU	O	M
Micrurus fulvius	RU, C, NPB	O	M
M. psyches	RU, DU	O	M
Naja melanoleuca	C	O	M, B?
N. naja	C, D, NC, OO	O	M, B
N. nigricollis	RU, DU	O	M
'Asp' (= Naja haje?)	RU, D	O	M
Ophiophagus hannah	C, NC	O	M
`Cockatrice'or`basilisk' (= Ophiophagus hannah or Naja sp.?)	RU, C	O	M
Pseudechis butleri	RU, C, D	O	M
Pseudonaja textilis	RU, C, NPB	O	M
Hydrophiidae			
Pelamis platurus	E, CN, C	V	M
Laticaudidae			
Laticauda colubrina	C, D, CN?	O	M
L. semifasciata	RU, DU	O	?
Leptotyphlopidae			
Leptotyplops dulcis	C	O	M
L. humilis	E?, C	O	M

Typhlopidae			
Ramphotyphlops braminus	RU, C, NPB	O	M
Rhinotyphlops caecus	RU, DU	O	M
Viperidae			
Agkistrodon contortrix	RU, CN, D	V	M
A. piscivorus	RU, CN, D?	V	M
Calloselasma rhodostoma	C, H, D	O	M
Causus rhombeatus	C	O	M
Crotalus sp.	RU, CN	V	M
C. adamanteus	E?, CN, D	V	M
C. atrox	CN, PP	V	M
C. horridus	CN, PP	V	M
C. viridis	CN, D, PP	V	M
Deinagkistrodon acutus	C	O	M
Lachesis muta	C, D	O	M
Porthidium nummifer	RU, CN	V	M
Sistrurus catenatus	RU, CN	V	M
Trimeresurus kaulbacki	DU, D?	O	M
T. monticola	C, D	O	M
T. okinavensis	C, D	O (V)	M
T. wiroti	C, H?	O	M
Vipera aspis	RU, CN, PP?	V	M
V. berus	CN, PP	V	M

*This species is viviparous (Lynn and Grant, 1940), not oviparous as reported by Gosse (1851). Perhaps Gosse confused an oviparous colubrid for *E. subflavus*.

**Female *L. triangulum* remain coiled around their eggs for a brief period after oviposition in order to compress them into an adherent mass before abandoning them (McCauley, 1945; Green and Pauley, 1987). This may account for the considerable number of references (Table VI) suggesting that this species broods its eggs.

+There is an unverified report of viviparity in *P. regius* (Anonymous, 1941).

TABLE III

Summary of the number of species and genera exhibiting parental behavior within lepidosaurian taxa (based on Tables I and II)

Taxa	Number* of genera	Number* of species
Squamata	107 (69)	209 (147)
Amphisbaenia	1 (0)	1 (0)
Trogonophidae or Amphisbaenidae (?)	1 (0)	1 (0)
Sauria	48 (36)	104 (82)
Agamidae	3 (1)	4 (2)
Anguidae	6 (6)	13 (13)

Cordylidae	1 (1)	2 (2)
Gekkonidae	11 (7)	18 (13)
Iguanidae	9 (6)	14 (11)
Lacertidae	2 (1)	2 (1)
Scincidae	13 (11)	41 (35)
Teiidae	1 (1)	2 (2)
Varanidae	1 (1)	6 (1)
Xantusiidae	1 (1)	2 (2)
Serpentes	58 (33)	104 (65)
Boidae	10 (7)	28 (24)
Colubridae	25 (14)	36 (20)
Elapidae	8 (3)	14 (7)
Hydrophiidae	1 (0)	1 (0)
Laticaudidae	1 (1)	2 (1)
Leptotyphlopidae	1 (1)	2 (1)
Typhlopidae	2 (0)	2 (0)
Viperidae	10 (7)	19 (12)
Rhynchocephalia	1 (1)	1 (1)
Sphenodontidae	1 (1)	1 (1)

*Number in parentheses represents actual total when erroneous and uncertain accounts are deleted from analysis (see Tables I and II).

TABLE IV

Prevalence of maternal, paternal and biparental behavior in lepidosaurians

Parent exhibiting behavior	Number* of species	Percent* of total
Maternal only	193 (142)	92.0 (96)
Paternal only	1 (1)	0.5 (0.7)
Biparental only	7 (2)	3.0 (1.3)
Maternal and biparental	4 (1)	2.0 (0.7)
Paternal or maternal	2 (2)	1.0 (1.3)
Sex of parent unknown	3 (0)	1.5 (0)

*Number in parentheses represents actual value when erroneous and uncertain sources are deleted from analysis.

TABLE V

Bibliographic sources for reports of lizard, amphisbaenians and rhynchocephalian parental behavior

Taxa	Sources
Agamidae	
Leiolepis belliana	Boulenger, 1903
Phrynocephalus sp.	Bertin and Burton, 1967
Uromastix aegyptius	Mendelssohn and Bouskila, 1989; H. Mendelssohn, pers. comm.
U. ornatus	Mendelssohn and Bouskila, 1989; G. Perry, pers. comm.; H. Mendelssohn, pers. comm.
Anguidae	
Barisia imbricata	Guillette and Hotton, 1986
Diploglossus bilobatus	Taylor, 1956
D. delasagra	Barbour and Ramsden, 1919
Elgaria coerulea	Stewart in Guillette and Hotton, 1986, and pers. comm.
E. multicarinata	Langerwerf, 1981; Jes, 1987
Gerrhonotus liocephalus	Greene and Dial, 1966; Greene in Tinkle and Gibbons, 1977
Mesaspis moreleti	Greene in Guillette and Hotton, 1986
Ophisaurus apodus	Petzold, 1971; Langerwerf, 1981, 1984; Claffey and Johnson, 1982*a*, *b*; Huff, 1985
O. attenuatus	?Hoy, 1883; Collins, 1959; Blair, 1961; Fitch, 1970, 1986, 1989; Vogt, 1981
O. compressus	Bartlett, 1985
O. gracilis	Wall, 1908; Smith, 1935; Jayaram, 1974; Daniel, 1983
O. harti	Pope, 1929, 1955
O. ventralis	Noble and Mason, 1932, 1933; Telford, 1952; Vinegar, 1968; Villiard, 1969; Mount, 1975; Somma, pers. observ.
Cordylidae	
Cordylus cataphractus	Branch, 1988; S. Jacobs, pers. comm.
C. giganteus	Patterson and Bannister, 1987; S. Jacobs, pers. comm.
Gekkonidae	
Ailuronyx sechellensis	High, [1976]; Miller, 1980; McKeown and Miller, 1985; Slavens, 1987
Chondrodactylus angulifer	Miller, 1983*a*
Eublepharis macularis	Miller, 1980
Gekko gecko	Honegger, 1969; Koch, 1972; Zaworski, 1987*a*, *c*, 1988; T. Miller, pers. comm.
G. petricolus	Zaworski, 1987*a*, *b*
G. smithii	Tho and Ho, 1979
Hemidactylus turcicus	Somma, pers. obs.
Hemiphyllodactylus typus	Eijsden, 1978
Naultinus grayi	Robb, 1980; J. Fawcett, pers. comm.

Phelsuma borbonica	Miller, 1982
P. dubia	Osadnik, 1984
P. flavigularis	Osadnik, 1984
P. lineata	Osadnik, 1984
P. madagascariensis	Osadnik, 1984; Rösler, 1988
P. standlingi	Digney and Tytle, 1983
Phyllodactylus lanei	Z. Uribe, pers. comm.; A. Ramírez, pers. comm.
Ptychozoon lionotum	Waitkus, 1983; Tytle et al., 1987
Teratoscincus scincus	Miller, 1983b
Iguanidae	
Amblyrhynchus cristatus	Heller, 1903; Eibl-Eibsfeldt, 1966; Trillmich, 1979; Fitch, 1982; Dellinger, 1989
Brachylophus fasciatus	Cogger, 1974; Gibbons and Watkins, 1982
B. vitiensis	Gibbons and Watkins, 1982; Gibbons, 1984/85
Conolophus pallidus	Christian and Tracy, 1982
C. subcristatus	Werner, 1982
Crotaphytus collaris	Burt and Hoyle, 1934
Cyclura carinata	Iverson, 1977, 1979
C. cornuta	Shaw, 1969; Wiewandt, 1977, 1979; Boylan, 1984
C. cychlura	Carey, 1975
C. nubila	Shaw, 1954; Crutchfield, 1982, 1986; Thompson in Blair, 1983a, b
Iguana iguana	Alvarez del Toro, 1960; Mertens, 1960; Wiewandt, 1982; Ellison, 1985
Phrynosoma douglassi	Lockwood, 1883
Sauromalus varius	Lawler and Jarchow, 1986; Lawler in Gilbert, 1987; Castillo S., 1989
Sceloporus undulatus	Hay, 1892
Lacertidae	
Acanthodactylus scutellatus	G. Perry, pers. comm.
Lacerta viridis	Mertens, 1960; Burton and Burton, 1984
Scincidae	
Calyptotis scutirostrum	Ehmann, 1988
Corucia zebrata	Hediger, 1937, 1986; Slavens, 1983; Honegger, 1985; Mehaffey, 1986; Peterson, 1986; A. Anderson, pers. comm.
Cyclodina pseudornata	J. Fawcett, pers. comm.
Egernia cunninghami	Niekisch, 1975, 1980; Zimmermann, 1986
E. striata	Pianka and Giles, 1982
E. whitii	McPhee, 1979
Emoia cyanura	J. Fitch in Fitch, 1970
Eumeces anthracinus	Clausen, 1938; Dowling, 1950; Hamilton, 1958; Anderson, 1965; Cooper et al., 1973; Collins, 1975
E. callicephalus	Campbell and Simmons, 1961; Zweifel, 1962; Williamson, 1986; Tanner, 1987, and pers. comm.
E. chinensis	[Wang, 1966]
E. copei	L. Guillette, pers. comm.
E. egregius	Hamilton and Pollack, 1958; Mount, 1961, 1963; Somma, pers. observ.

E. elegans	Mell, 1929; Hikida, 1981
E. fasciatus*	Ditmars, 1904, 1907; Allard, 1909; Ruthven, 1911; Dunn, 1920; Blanchard, 1922; Bishop, 1926; Burt, 1928, 1937; Corrington, 1929; Klots, 1930; Noble and Mason, 1932, 1933; Burt and Burt, 1935, Taylor, 1935; Conant, 1938, 1951; McCauley, 1939, 1945; Cagle, 1940; Anderson, 1942, 1965; McClellan et al., 1943; Minton, 1944, 1972; H. Smith, 1946; Neill, 1948; Evans and Roeker, 1951; Fitch, 1954, 1967; Parmalee, 1955; Kennedy, 1956; Reynolds, 1959; Tinkle, 1959, P. Smith, 1961; Leviton, [1972]; Snyder, 1972; Burghardt, 1973; Mount, 1975; Fitch and von Achen, 1977; Vogt, 1981; Groves, 1982; Lang, 1982, 1983; Cooper et al., 1983; Cooper and Vitt, 1985; Stewart and Duvall, 1985; Vitt and Cooper, 1986, 1989; Green and Pauley, 1987; Johnson, 1987; Cochran, 1989; Somma, pers. observ.
E. inexpectatus	Smith, 1946; Duellman and Schwartz, 1958; Hamilton, 1958; Molchos, 1971; ?Loop and Scoville, 1972; Mount, 1975; Vitt and Cooper, 1986; Dundee and Rossman, 1989; Somma, pers. observ.
E. laticeps	Hurter, 1911; Noble and Mason, 1932, 1933; Taylor, 1935; Cook, 1943; McClellan et al., 1943; Mansueti, 1948; Martof, 1956; Smith, 1961; Mount, 1975; Johnson, 1979; Moehn, 1980; Schuette, 1980; Ashton and Ashton, 1985; Cooper and Vitt, 1985; Hammond, 1985; Vitt and Cooper, 1985a, b, 1989; Green and Pauley, 1987; Johnson, 1987; Meshaka et al., 1988; Somma, pers. observ.
E. latiscutatus	Sengoku, 1979; Hikida, 1981; [Mathui, 1985]
E. lynxe	L. Guillette, pers. comm.
E. multivirgatus	Gehlbach, 1965; Van Devender and Van Devender, 1975; A. Aquino, pers. comm.; J. Lynch, pers. comm.
E. obsoletus	Taylor, 1935; Smith, 1946; Fitch, 1955, 1956, 1964, 1967, 1970; Fouquette and Lindsay, 1955; Evans, 1959; Hall, 1972; Hall and Fitch, 1972; J. Lynch, pers. comm.; Somma, pers. observ.
E. okadae	[Hikida, 1975]; Sengoku, 1979; Hasegawa, 1984, 1985, and pers. comm.; [Mathui, 1985]
E. oshimensis	Toyama, 1975
E. parviauriculatus	Tanner, 1987, and pers. comm.
E. quadrilineatus	Mell, 1929
E. schneiderii	Zimmermann, 1986
E. septentrionalis	?Hoy, 1883; Breckenridge, 1941, 1943, 1944; Smith and Slater, 1949; Nelson, 1963; Bredin, 1981, 1989 [pers. comm.]; Lang, 1982, 1983; [Gerholdt], 1984b; Somma, 1985a, b, c, 1987a, b, c, 1989a; Somma and Fawcett, 1985, 1989; McAllister, 1987; (reviewed in Somma and Cochran, 1989)

E. skiltonianus	Heller in McClain, 1899**; Van Denburgh, 1922; Woodbury, 1931; Tanner, 1943, 1957
E. stimsoni	Taylor, 1935
E. tetragrammus	Strecker, 1908; Werler, 1951; Behler and King, 1979
E. xanthi	Pope in Schmidt, 1927; Mell, 1929
Lampropholis mustelina	Ehmann, 1988
Leiolopisma otagense	Smithells in Sharrell, 1966
L. smithii	J. Fawcett, pers. comm.
L. zia	Ehmann, 1988
Mabuya capensis	Rose, 1929, 1950; FitzSimons, 1943
M. macrorhyncha	Rebouças-Spieker and Vanzolini, 1978
M. macularia	Daniel, 1983
Neoseps reynoldsi	Telford, 1959
Sphenomorphus quoyii	Shine, 1988
Scincus scincus	Gesneri, 1551-1587; Topsell, 1608
Tiliqua rugosa	Mertens, 1960; Hitz, 1983
Teiidae	
Tupinambis teguixin	Reese, 1922; Krieg, 1925; Fitzgerald et al., 1989, In press
T. rufescens	Fitzgerald et al., 1989, In press
Varanidae	
Varanus gouldii	Berney, 1936
V. griseus	Auffenberg, 1981
V. komodoensis	Lallemant, 1929; Pfeffer, 1959; Auffenberg, 1981
V. mitchelli	Gow in Shine, 1988
V. salvator	Biswas and Kar, 1981
V. varius	Cogger, 1967, and in Shine, 1988; Mertens, 1987; Carter, 1989, and pers. comm.
Xantusiidae	
Xantusia henshawi	Shaw, 1949
X. vigilis	Cowles, 1944; Miller, 1954
Trogonophidae or Amphisbaenidae (?)	
\`Amphisbaina' (= species?)	Gesneri, 1551-1587; Topsell, 1608; Aldrovandi, 1640
Sphenodontidae	
Sphenodon punctatus	Thompson, 1988, and in Shine, 1988 and Heaton-Jones, 1989; Guillette et al., in review

*Prior to 1932, *Eumeces inexpectatus* and *E. laticeps* were included within the species *E. fasciatus* (Cope, 1900; Davis, 1968; Steiner, 1986). The *fasciatus* group was divided into three species by Taylor (1932*a*, *b*, 1935); *E. fasciatus*, *E. inexpectatus* and *E. laticeps*. Consequently, some references pertaining to *E. fasciatus* prior to 1932 may actually refer to either, *E. inexpectatus* or *E. laticeps*.

**Identity of species as described in this account is uncertain. This could refer to Eumeces gilberti; if so, it is the only record of brooding in this species.

TABLE VI

Bibliographic sources for reports of snake parental behavior

Taxa	Sources
Boidae	
Aspidites melanocephalus	Ross, 1978; Boos, 1979; Murphy et al., 1981; Barker, 1982, 1985; Charles et al., 1985
Boa constrictor	Lanworn, 1972; Wells, 1981
Casarea dussumieri	Bloxam, 1984
Chondropython viridis	Kibler in Lederer, 1944; Pope, 1961; Kratzer, 1962; MacKay, 1973; Switak, 1975; Walsh, 1977, [1980]; Ross 1978; Olexa, 1979; Christian, 1981; Engelmann and Obst, 1981; Slavens, 1982, 1983, 1984, 1985, 1987; Hudson, 1983; Van Mierop et al., 1983; Zulich, 1983, 1985; [Orlov], 1986; Wexo, 1987
Epicrates cenchria	Boos, 1976; Brunner, 1979; Groves, 1981; Walsh and Davis, 1984
E. striatus	Huff, 1980; Slavens, 1987
E. subflavus	Gosse, 1851
Eunectes murinus	Neill and Allen, 1962; Holmstrom and Behler, 1981
E. notaeus	Holmstrom, 1981; Slavens, 1985, 1988; Townson, 1985
Liasis albertisii	Kinghorn, 1956; Johnson, 1975; Ross and Larman, 1977; Ross, 1978; Tarbet, 1984; Slavens, 1986; B. Clark, pers. comm.
L. boa	Barker, 1982; Mehrtens, 1987
L. childreni	Ross, 1973, 1980a,1983; Dunn, 1979a; Sheargold, 1979; Barker, 1982; Slavens, 1988
L. fuscus	Kinghorn, 1956; Gow, 1976; Ross and Larman, 1977; Ross, 1978, 1980b; Boos, 1979, 1983; McPhee, 1979; Barker, 1982; Weidner in Funk, 1982; Orlow, 1982; Bulian and Broer, 1984; Charles et al., 1985; [Orlov], 1986; Mehrtens, 1987; Shine, 1988
L. olivaceus	Kinghorn, 1956
L. papuanus	Tryon, 1985; Tryon and Whitehead, 1988
L. perthensis	Stafford, 1986
Morelia amethistina	Pope, 1961; Ross, 1978; Boos, 1979; McPhee, 1979; Parker, [1982]; Banks and Schwaner, 1984; Charles et al., 1985; Grow, 1987; B. Clark, pers. comm.

M. bredli	Gow, 1981, 1983
M. spilota	Allan in G. Krefft, 1869; P. Krefft, 1926; Fleay, 1956; Cogger and Holmes, 1960; Gow, 1976, 1983; Ross, 1978; Worrel in Boos, 1979; McPhee, 1979; Harlow in Shine, 1980; Weidner in Funk, 1982; Broer, 1983; Burton and Burton, 1984; Harlow and Grigg, 1984; Charles et al., 1985; Bels and Van den Sande, 1986; Slip, 1986; Lombard, 1987; Slip and Shine, 1988*a*, *b*; Anonymous, [19??]
Python anchietae	McLain, 1983; Laszlo, 1984; Branch, 1988
P. curtus	Noble, 1935; Stemmler, 1969; Vinegar et al., 1970; Reitinger and Lee, 1978; Katuska, 1983; Stafford, 1986; Trutnau, 1986; T. Weidner, pers. comm.
P. molurus	Bennett, 1824; Lamarrepiquot [=Lamarre-Piquot], 1835*a*; Valenciennes, 1841*a*, *b*; Duméril, 1842; Lamarre-Piquot, 1835*b*, 1842, 1858*a*, *b*; Forbes, 1881; Holland in Hopley, 1882; Marshall, 1893; Pinkert, 1893; Kern, 1907; Wall, 1912, 1921; Abercromby, 1913; Doflein, 1914; Krogh, 1916; Leigh, 1926, 1936; Lederer, 1928, 1944, 1956; Schlott, 1935; Kopstein, 1938; Patsch, 1943; Smith, 1943; Walker and Stoddart in Angel, 1950; Deraniyagala 1955; Stemmler-Morath, 1956; Vogel, [1958?]; Anonymous, 1960*a*, Dowling, 1960; Lutz, 1962; Deoras, 1965; Wendt, 1965; Hutchison et al., 1966; Yadav, 1967; Vinegar et al., 1970; Wagner, 1973, 1976; Coborn, 1975, 1985; Foekema, 1975; Acharjyo and Misra, 1976; Van Mierop and Barnard, 1976*a*,*b*, 1978; Frank, 1977; Acharjyo, 1978; Getreuer, 1979; Townson, 1980, [1989]; Frye, 1981; Griehl, 1982; Clark and Tytle, 1983; Gurung, 1983; Van Mierop et al., 1983; [Gerholdt], 1984*a*, Conners, 1985; Slavens, 1985, 1987, 1988; Alderton, 1986; Michaels, 1986; Trutnau, 1986; Whitaker and Whitaker, 1986; Clark, 1988; Obst et al., 1988; Schleich and Kästle, 1988; Cox, 1989
P. regius	Pitman, 1938; Schivre, 1972; Logan, 1973; Peters, 1976; Boos, 1979; Van Mierop and Bessette, 1981; Malone, 1982; Orlow, 1982; Lehmann and Lehmann, 1983; Laszlo, 1984; Barten, 1986; [Orlov], 1986; Trutnau, 1986; Ellis and Chappell, 1987; Slavens, 1987; Kirschner and Ochsenbein, 1988
P. reticulatus	Abbott in Wray, 1862; Köhler, 1907; Ditmars, 1910; Hilzheimer, 1910;

	Benedict, 1932; Kopstein, 1938; Lederer, 1944, 1956; Taylor, 1965; Honegger, 1970, 1970/71, 1975; Müller, 1970; Vinegar et al., 1970; Foekema, 1971; La Panouse and Pellier, 1973; Johnson, 1977; Trutnau, 1980, 1986; Slavens, 1984
P. sebae	Günther, 1862; Sclater, 1862; [Günther], 1886; F. FitzSimons, [1912], 1930; Werner, 1930 (in Angel, 1950); Benedict and Mann in Ditmars, 1931; Benedict, 1932; Benedict et al., 1932; Pitman, 1938; Lederer, 1942, 1944, 1956; Broadley, 1959; Anonymous, 1960a,b; Dowling, 1960, 1961; Sweeney, 1961; V. FitzSimons, 1962, 1970; Meyer-Holzapfel, 1969; Schütte, 1970; Vinegar et al., 1970; Munnig Schmidt, 1971, 1973; Patterson, 1974; Branch and Patterson, 1975; Broadley and Cock, 1975a, b; Pienaur et al., 1978; Dunn, 1979b; Slavens, 1985; Trutnau, 1986; Patterson and Bannister, 1987; Branch, 1988; Schleich and Kästle, 1988; Shine, 1988
P. timoriensis	Murphy et al., 1978; Barker, 1982
`Lilith' or `arrow snake' (= Eryx jaculus?)	Isaiah 34:15, [c. 745-350 BC], (McDowell et al., 1982)
Colubridae	
Ahaetulla nasuta	Rieppel, 1970
Amphiesma stolata	Wall, 1911, 1921; Mell, 1929; Daniel, 1983
Atretium schistosum	Murthy, 1986
Cemophora coccinea	Ditmars, 1907
Cerberus rynchops	Whitaker, 1978; Trutnau, 1986
Clelia clelia	Brazil, 1914, and in Roosevelt, 1914
Coronella austriaca	Appleby, 1971
Diadophis punctatus	?McCauley, 1945; Cook, 1954; Fowlie, 1965; ?Brodie et al., 1969; Somma, pers. observ.
Elaphe climacophora	Fukada, 1965
E. flavolineata	Kopstein, 1938
E. guttata	Kelly et al., 1936; Haast and Anderson, 1981; Kent in Shine, 1988; T. Miller, pers. comm.
E. obsoleta	Ditmars, 1907; Medsger, 1919, 1932; ?Netting, 1927; ?McCauley, 1945; Pope, 1946; M. Fisher, pers. comm.; J. Lombard, pers. comm.
E. quadrivirgata	Fukada, 1965; Orlow, 1982
E. quatuorlineata	Vogel, [1958?]
E. schrenki	Kudryavtsev and Frolov, 1984
Farancia abacura	Ridgeway, 1883 (in Hay, 1892; Wright and Wright, 1957; Minton, 1972); Meade, 1937, 1940, 1945, 1946; Conant and Downs, 1940;

	Goldstein, 1941; Cagle, 1942; Reynolds and Solberg, 1942; Cook, 1954; Riemer, 1957; Tinkle, 1959; Hahn and Wilson, 1966; Crawford, 1984; Mehrtens, 1987; Dundee and Rossman, 1989
Farancia erytrogramma	Fry in Wright and Wright, 1957; Neill, 1964a; Ashton and Ashton, 1981
Heterodon platirhinos	Hay, 1892, 1893; Hahn 1909
Hydrodynastes gigas	Vogel 1964
Lampropeltis triangulum	Ditmars, 1907; Noble, 1920; Babcock, 1929; Anonymous, 1940; Minton, 1972; Minton and Minton, 1973; Marsec in Shine, 1988
Lycodon aulicus	Herklots, 1935
L. striatus	Wall, 1921
Masticophus flagellum	Meek, 1946
Natrix natrix	Stradling in Hopley, 1882; Gallwey, 1932; Berridge, 1935; Smith, 1951; Parker, 1963; Appleby, 1971
Oligodon taeniolatus	Daniel, 1983
Opisthotropis latouchii	Pope, 1929
Pituophis catenifer	Carl, 1944
Psammophylax rhombeatus	F. FitzSimons, [1912]; V. FitzSimons, 1962, 1970; Le Roux, 1964; Bourquin, 1970; Visser, 1971; De Waal, 1978; Branch, 1981, 1988; Broadley, 1983; Jacobsen, 1985; Trutnau, 1986; Patterson and Bannister, 1987
P. tritaeniatus	Sweeney, 1961; Isemonger, 1968; Branch, 1981; Hedges, 1983; Patterson and Bannister, 1987
P. variabilis	Spawls in Broadley, 1977
Ptyas korros	Mell, 1929
P. mucosus	Wall, 1907, 1921; Mell, 1929; Kopstein, 1938; Daniel, 1983
Rhabdophis subminiata	Mell, 1929
Sinonatrix percarinata	Pope, 1929, 1935
Tropidonophis mairii	?Sundowner, 1895*, 1902; Bredl in Shine, 1988
Xenochrophis piscator	Abercromby, 1913; Mell, 1929; Whitaker, 1978; Daniel, 1983; Whitaker and Whitaker, 1986
Elapidae	
Bungarus caeruleus	Wall, 1921; Daniel, 1983; Whitaker and Whitaker, 1986
B. candidus	Mell, 1929; Shaw and Shebbeare, 1931; Soderberg, 1973
B. ceylonicus	Green, 1905
B. fasciatus	Evans, 1905; Wall, 1921; Mell, 1929; Soderberg, 1973; Yahya, 1985
'Dipsas' (= Bungarus sp.?)	Nicander of Colophon [135-133? BC]
Calliophis maculiceps	Frith, 1977 (also illustrated in Phelps, 1981)
Demansia papuensis	Parker, [1982]

Micrurus fulvius	Campbell, 1973
M. pysches	Mole, 1924
Naja melanoleuca	Tryon, 1979; Dowling, 1986
N. naja	[Appuhamy, 1810] (see Deraniyagala, 1955); Fayrer, 1870; Kipling, 1894+; Wall, 1921; Mell, 1929; Jennison, 1931; Kopstein, 1938; Smith, 1943; Simmon, 1944; Tweedie, 1954; Deraniyagala, 1955; Rao, 1957; Ducket, 1964; Deoras, 1965; Petzold, 1968; Miller, 1970; Campbell and Quinn, 1975, Daniel, 1983; Whitaker and Whitaker, 1986
'Asp' (= *Naja haje*?)	Nicander of Colophon [135-133? BC]
N. nigricollis	Håkansson, 1981
Ophiophagus hannah	Fayrer, 1870; Nicholson, 1870; Wasey, 1892; Evans, 1903; Joynson, 1917; Wall, 1924; Berridge, 1935; Mustill, 1936; Smith, 1936; Oliver, 1956; Leakey, 1969; Ionides and Leakey in Soderberg, 1973; Burchfield, 1977; Whitaker, 1977, 1978; Reitinger and Lee, 1978; Daniel, 1983; Gurung, 1983; Whitaker and Whitaker, 1986; Dattatri, 1987; Mehrtens, 1987; Shine, 1988
`Cockatrice'or 'Basilisk' (= *Ophiophagus hannah* or *Naja* sp.?)	Gesneri, 1551-1587; Topsell, 1608
Pseudechis butleri	Fitzgerald and Mengden, 1987
Pseudonaja textilis	Fleay, 1943; Edwards and Wells in Shine, 1988; Shine, 1989
Hydrophiidae	
Pelamis platurus	Bertin and Burton, 1967
Laticaudidae	
Laticauda colubrina	Semper, 1881; ?Sundowner, 1895, 1902*; Smedley, 1931; Neill, 1964*b*, Taylor, 1965
L. semifasciata	Herre and Rabor, 1949
Leptotyphlopidae	
Leptotyphlops dulcis	Hibbard, 1964
L. humilis	Whitfield, 1983++
Typhlopidae	
Ramphotyphlops braminus	Mell, 1929
Rhinotyphlops caecus	Bogert, 1940
Viperidae	
Agkistrodon contortrix	Anderson, 1942; Fitch, 1960; Kennedy, 1964
A. piscivorus	Wharton, 1960, 1966
Calloselasma rhodostoma	Smith, 1915, 1943; Tweedie, 1954; Leakey, 1969; Campden-Main, 1970; Reitinger and Lee, 1978; Liat, 1982; York and Burghardt, 1988; Gloyd and Conant, 1989

Causus rhombeatus	F. FitzSimons, [1912]; Woodward, 1933; Sweeney, 1961; Broadley, 1983
Crotalus sp.	Audubon, 1909
C. adamanteus	Meek, 1946
C. atrox	Price, 1988
C. horridus	Anderson, 1942, 1965; Lokke, 1985; Martin, 1986a,b, 1989, and pers. comm.; ?Bartlett, 1987; ?Brown, 1987; ?Reinert and Zappalorti, 1988
C. viridis	Gloyd, 1937; Jackley and Shelton in Klauber, 1972; Duvall et al., 1985; Graves, 1988, 1989
Deinagkistrodon acutus	Fleck, 1987
Lachesis muta	Mole, 1924, and in Ditmars, 1910; Donisthorpe, 1947; Ramsey and Travis, 1960; Wehekind, 1960; Emsley, 1977; Caycedo, 1978; Frieberg, 1982
Porthidium nummifer	Picado T., 1931
Sistrurus catenatus	Greene and Oliver, 1965; ?Vogt, 1981; Reinert and Kodrich, 1982
Trimeresurus kaulbacki	Obst et al., 1988
T. monticola	Leigh, 1910; Pope, 1929, 1935
T. okinavensis	?Fukada, 1964; Koba et al., 1970
T. wiroti	Mehrtens, 1987
Vipera aspis	Lanworn, 1972; Naulleau, 1987; Dowling, 1986
V. berus	Brittain, 1866 (in Hopley, 1882); Service, 1902; Smith, 1951; Appleby, 1971; Street, 1979; Naulleau, 1987

*It is not known what species Sundowner actually observed but T. mairii and L. colubrina seem likely candidates. The credibility of Sundowner's [= Tichborne, H. (sic?)] (1895, 1902) observations are at best questionable, and mostly fabricated (Johnson and Smith, 1985). Nevertheless, it is likely that he also observed Australian pythons (species unspecified) brooding their eggs (Sundowner, 1895, 1902).

+Although a work of fiction, Kipling (1894) was one of the earliest published accounts of brooding in Naja naja (mistakenly referred to as Ophiophagus hannah) in English. He based his story, "Rikki-tikki-tavi," on a personal communication from an anonymous herpetologist (Kipling, 1894).

++Whitfield's (1983) mention of brooding in L. humilis is likely a mistaken reference to Hibbard's (1964) observations on L. dulcis.

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AMPHIBIANS AND REPTILES AS PREY OF BIRDS IN SOUTHWESTERN EUROPE

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&
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Museo Nacional de Ciencias Naturales de Madrid

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INTRODUCTION

This review surveys species of amphibians and reptiles that are reported prey of birds in southwestern Europe. These ectothermic animals are important in Mediterranean and temperate ecosystems, because they are the prey for many specialist birds (eg, the short-toed eagle, Circaetus gallicus, a snake eater). However, European herpetologists know the identity of few amphibian and reptilian predators. In the recently published "Handbuch der Reptilien und Amphibien Europas", references to predation are scarce and even ignored. However, the ornithological literature contains numerous papers on bird diets, and amphibians and reptiles are frequently cited as bird preys.

The Cramp's "Handbook of Birds of the Western Paleartic" was the first book examined; however, most of the predation records were obtained from the main European ornithological journals from Southwestern Europe. Including the Iberian Peninsula (Spain and Portugal), France, Belgium, The Netherlands, and the British Isles -approximately between 10°W and 10°E longitude.

References are listed and numbered alphabetically and can be accessed through either predator or prey. Species are listed systematically.

All scientific names have been updated. Some report provide only general identifications i.e., frog, toad, lizard or snake. In such cases, we have tried to identify the prey precisely as possible. We had problems with the "green frog" group, which includes Rana ridibunda, R. perezi, R. lessonae, and R. esculenta. Since these species are taxonomically complex, we cited them here as green frogs. The same identification problems occurred with the genera Discoglossus, Hyla, and Podarcis.

The number of references is not a good index for predation rate, it only means that one species is more frequently cited. Although some preys occur only occasionally in bird diet, other species apparently experience heavy predation. This aspect is often ignored in ecological studies.

Please remembered that this survey was limited to regional journals and books and complete only for 1950 through 1988 for these. The journals are: Belgium (Le Gerfaut), France (Acta Biologica Montana, Alauda, Aves, Le Biévre, Le Cormoran, L'Oiseau et la Revue Francaise

d'Ornithologie, Nos Oiseaux), Great Britain (Bird Study, British Birds, The Ibis, Scottish Birds), Portugal (Cyanopica), Spain (Alytes, Ardeola, Boletín de la Estación Central de Ecología, Boletin de la Real Sociedad de Historia Natural, Cuadernos de Ciencias Biológicas, Doñana Acta Vertebrata, Mediterránea, Miscellanea Zoologica, Monografías del I.C.O.N.A., Munibe, Naturalia Hispanica, Publicaciones del Centro Pirenaico de Biología Experimental).

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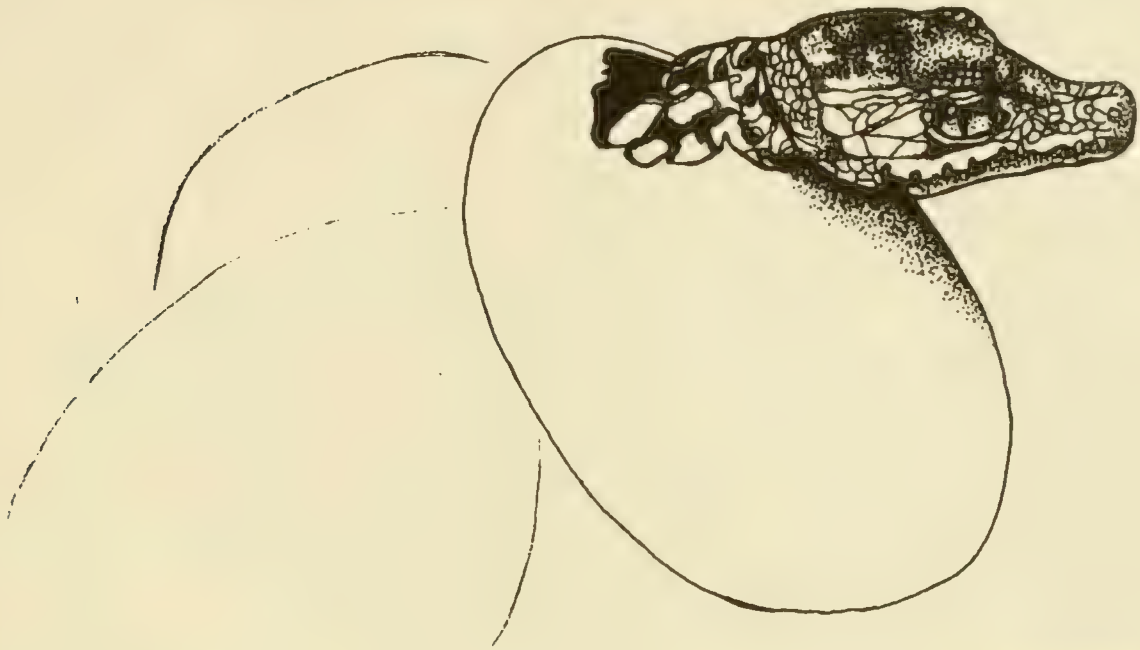
SEX DETERMINATION IN REPTILES: SUMMARY OF EFFECTS OF CONSTANT TEMPERATURES OF INCUBATION ON SEX RATIOS OF OFFSPRING



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INTRODUCTION

The phenomenon of environmental sex determination (ESD) in reptiles has been highly publicized in recent years. However, the underlying mechanism(s) that control this process are still poorly known. Additionally, the distribution of ESD within the Reptilia is poorly known, with only 93 of the approximately 6500 species of extant reptiles having been examined for the presence of ESD (Janzen and Paukstis, Quart. Rev. Biol.).

This paper provides a summary of much of the research conducted on ESD in reptiles from laboratory studies that have employed constant temperatures of incubation (Table 1). Table 1 is an extension of and appendix to a review article on ESD in reptiles (Janzen and Paukstis, Quart. Rev. Biol.). As a result of the recent proliferation of publications concerning various aspects of ESD in reptiles, this table originated as a tool to provide an overview of laboratory results that were currently available. As the data accumulated, we were impressed not by their consistency, but by the amount of variability that existed among different studies. Although each of these studies individually provided important new data on ESD, when many papers were viewed simultaneously it became very difficult to compare results.

The potential sources of this variability in sex ratios among different studies are many but, in general, fall into two broad categories--biological and artifactual. Among biological sources of variability are such factors as inter- and intrapopulational genetic differences, nongenetic maternal influences, and different regulatory mechanisms that may vary taxonomically within the Reptilia. Artifacts (nonbiological and experimental) include differences in experimental design and implementation (e.g., how closely temperature was monitored or regulated, randomization of eggs across experimental treatments, small sample sizes) and different techniques in sexing hatchlings (e.g., presence/absence of oviducts, histological confirmation).

Another factor that may reduce the value of results from some studies is the manner in which the results are presented (e.g., actual sample sizes as opposed to just the sex ratios of hatchlings, data on embryonic mortality). An additional problem is inconsistency and lack of definition of terminology. For example, what is the actual relationship between the morphology of a given gonad and the terminology used to describe it in hatchlings from different studies, when these hatchlings have been described as "hermaphrodites", "intersexes", "unsexable", or "unsexed"? Even though the answer to this question may be obvious, unless the terminology in each of these papers has been adequately defined, it is difficult to ascertain precisely how the gonads of these hatchlings may or may not differ. To properly understand ESD in reptiles, it is very important to differentiate between these biological and artificial/experimental sources of variation and to strive to minimize those sources of variation that may mask actual biological effects.

In this paper we provide a compilation of much of the published empirical research on ESD in reptiles. Specifically, we summarize information on incubation temperatures, sex ratios, and sample sizes from laboratory studies that have used constant temperatures of incubation. Comments are provided in those instances where they may lend insight into variability of sex ratios or to denote information that may be of particular interest. The arrangement of the major taxa used in Table 1 follows that of Janzen and Paukstis (Quart. Rev. Biol.). Families are listed alphabetically within the major taxa and genera are presented alphabetically within families.

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Table 1. SUMMARY OF OFFSPRING SEX RATIOS FROM STUDIES USING CONSTANT TEMPERATURES OF INCUBATION

The number of males and females presented in this table were, in some cases, calculated from percentages provided in the sources indicated. In other cases, percentages were calculated from sample sizes. Question marks (?) denote data that were not presented in the source.

Taxa	Temp (C)	Males # ♂♂ (%)	Females # ♀♀ (%)	# eggs/# clutches	Comments	Source
TESTUDINES						
CRYPTODIRA						
CARETTOCHELYIDAE						
Carettochelys insculpta						
	28	12(100)	0(0)	12/3	Eggs in 2nd group at	98
	30	20(100)	0(0)	24/5	32° were collected	
	32	0(0)	9(100)	12/3	late in development	
	32	23(50)	23(50)	46/5		
CHELONIIDAE						
Caretta caretta						
	26	20(100)	0(0)	20/5	89% hatching success	38
	32	0(0)	20(100)	20/5	83% hatching success	
	25	?(100)	0(0)	10/1		53
	26	?(100)	0(0)	10/1		
	27.5	?(80)	?(20)	10/1		
	29	?(50)	?(50)	10/1		
	30.5	0(0)	?(100)	10/1		
	32	0(0)	?(100)	10/1		
	25	8(100)	0(0)	10/1	2 unsexable	54
	25	7(100)	0(0)	10/1		
	26	16(100)	0(0)	16/2		
	26	6(67)	3(33)	10/1		
	26	10(100)	0(0)	10/1		
	26	7(88)	1(12)	10/1	1 unsexable	
	27	8(80)	2(20)	10/1		
	27	6(86)	1(14)	10/1	2 unsexable	
	27.5	5(56)	4(44)	10/1		
	27.5	3(30)	7(70)	10/1		
	27.5	8(80)	2(20)	10/1		
	28	4(44)	5(56)	10/1		
	28	2(100)	0(0)	10/1		
	29	1(11)	8(89)	10/1		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	29	5(56)	4(44)	10/1		
	29	2(20)	8(80)	10/1		
	29	5(50)	5(50)	10/1		
	29	6(60)	4(40)	10/1		
	30	0(0)	7(100)	10/1		
	30	3(33)	6(67)	10/1		
	30	2(20)	8(80)	10/1		
	30.5	0(0)	1(100)	1/1		
	30.5	2(33)	4(67)	7/1		
	30.5	0(0)	10(100)	10/1		
	31	0(0)	8(100)	10/1	1 unsexable	
	31	0(0)	16(100)	20/2		
	32	0(0)	19(100)	20/2		
	32	0(0)	6(100)	10/1	1 unsexable	
	27.5	6(86)	1(14)	?/2	North Carolina (NC)	62
	28.0	26(90)	3(10)	?/2	NC	
	28.5	22(69)	10(31)	?/2	NC	
	28.5	9(33)	18(67)	?/2	Georgia (GA)	
	28.5	25(74)	9(26)	?/2	Florida (FL)	
	28.8	19(79)	5(21)	?/2	NC	
	28.8	12(34)	23(66)	?/2	GA	
	28.8	22(65)	12(35)	?/2	FL	
	29.2	4(50)	4(50)	?/2	NC	
	29.5	8(33)	16(67)	?/2	NC	
	29.5	8(20)	31(78)	?/2	GA; 1 intersex	
	29.5	12(35)	25(65)	?/2	FL	
	30.0	3(37)	5(63)	?/2	NC	
	30.4	0(0)	25(100)	?/2	GA	
	30.4	2(5)	36(92)	?/2	FL; 1 intersex	
	30.5	0(0)	23(100)	?/2	NC	
	24	11(100)	0(0)	23/3		104,105, 106
	26	24(100)	0(0)	26/5		
	28	20(100)	0(0)	26/5		
	30	5(36)	9(64)	15/1	Incubated in 1978	
	30	5(56)	4(44)	15/2	Incubated in 1979	
	30	4(80)	1(20)	6/2	Incubated in 1980	
	32	0(0)	21(100)	26/5		
	34	0(0)	7(100)	26/5		
Chelonia mydas						
	26	16(84)	0(0)	20/1	3 intersexes	57
	29	0(0)	37(90)	41/1	4 intersexes	
	33	0(0)	12(86)	20/1	2 intersexes	
	27.75	19(68)	6(21)	38/3	3 intersexes	63
	28.1	17(61)	10(36)	37/3	1 intersex	
	29.25	11(35)	18(58)	38/3	2 intersexes	
	30.0	9(43)	11(52)	37/3	1 intersex	

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	27.5	587(~44)	763(~56)	?/?	Numbers for each	100
	27.5	1178(~27)	3181(~73)	?/?	sex are estimates	
	27.5	23(~77)	7(~23)	?/?	owing to imprecision	
	27.5	1572(~67)	786(~33)	?/?	in sex ratios given	
	27.5	237(~67)	118(~33)	?/?		
	30.0	97(~ 1)	13661(~99)	?/?		
Lepidochelys olivacea						
	26.5	?(100)	0(0)	?/1		24
	29.5	0(0)	?(100)	?/1		
	31.5	0(0)	?(100)	?/1		
	25	23(100)	0(0)	50/3		56
	28	30(88)	1(3)	50/3	3 unsexable	
	30	12(48)	8(32)	50/3	5 unsexable	
	32	0(0)	23(100)	50/3		
	26.5	?(100)	0(0)	?/>1		60
	28.0	?(100)	0(0)	?/>1		
	29.5	?(40)	?(60)	?/>1		
	30.0	0(0)	?(100)	?/>1		
	31.0	0(0)	?(100)	?/>1		
	31.5	0(0)	?(100)	?/>1		
	27.5	?(100)	0(0)	?/?		61
	29.5	?(?)	?(?)	?/?	Both sexes produced	
	31.5	0(0)	?(100)	?/?		
	25.7	160(98)	1(1)	?/9	3 intersexes	84
	~27.4	59(98)	1(2)	?/3		
CHELYDRIDAE						
Chelydra serpentina						
	25	10(100)	0(0)	10/?		21
	30	0(0)	11(100)	11/?		
	28.5	?(?)	?(?)	?/?	Both sexes produced	22
	31	0(0)	4(80)	5/?	1 intersex	
	26.0	7(88)	1(12)	?/2	44 eggs incubated	23
	28.5	3(23)	10(77)	?/2	in total for this	
	31.0	0(0)	13(100)	?/2	experiment	
	21.5	2(25)	6(75)	?/?	Indiana	28
	21.5	0(0)	3(100)	?/?	Tennessee	
	22.5	5(50)	5(50)	?/?	Indiana	
	22.5	32(94)	2(6)	?/?	Minnesota	
	25	33(92)	3(8)	36/?		33
	31	0(0)	33(100)	33/?		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	26	36(95)	2(5)	?/?		34
	23	54(100)	0(0)	54/9		42,43
	26	50(100)	0(0)	50/9		
	29	0(0)	63(100)	63/15		69
	20	0(0)	21(100)	85/5	Eggs in the two 20°	102
	20	0(0)	37(100)	66/2	treatments were	
	22	19(90)	2(10)	21/3	switched to 26°	
	24	18(100)	0(0)	18/3	after 88 days and	
	26	108(100)	0(0)	132/16	83 days, respectively	
	26	79(98)	2(2)	91/7		
	28	17(65)	9(35)	27/3		
	30	0(0)	5(100)	23/5		
	30	0(0)	48(100)	72/6		
	30	0(0)	34(100)	56/5		
	20	0(0)	149(100)	245/?	Eggs in the 20°	103
	26	373(99)	3(1)	431/?	treatment completed	
	30	0(0)	142(100)	196/?	incubation at 26°	
Macroclemys temmincki						
	25	?(60)	?(40)	?/?		6
	31	0(0)	?(100)	?/?		
	22.5	2(11)	16(89)	?/?		28
	25	9(69)	4(31)	?/?		
	27	10(71)	4(29)	?/?		
	30	0(0)	11(100)	?/?		
DERMOCHELYIDAE						
Dermochelys coriacea						
	27.4	50(100)	0(0)	50/5	Temps measured every	25
	28.1	50(100)	0(0)	50/5	2-5 days at 0700 &1800	
	27	?(100)	0(0)	~25/1		52
	~28	?(100)	0(0)	~25/1		
	~29	?(100)	0(0)	~25/1		
	31	0(0)	40(100)	40/?		
	27	33(100)	0(0)	75/2		79
	27.25	5(100)	0(0)	11/1		
	28	4(100)	0(0)	38/2		
	28.25	1(100)	0(0)	10/1		
	28.75	15(100)	0(0)	51/2		
	29.75	0(0)	4(100)	11/1		
	30.5	0(0)	18(100)	59/3		
	32	0(0)	3(100)	35/2		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	29.25	9(100)	0(0)	140/4		80
	29.5	1(25)	3(75)	16/1		
	29.5	12(86)	2(14)	16/1		
	29.75	0(0)	32(100)	68/2		
EMYDIDAE						
Batagurinae						
Chinemys reevesii						
	~25	18(100)	0(0)	25/?		40
	32	0(0)	12(92)	25/?	1 intersex	
Mauremys mutica						
	25	3(75)	1(25)	?/?		28
	30	0(0)	9(100)	?/?		
Melanochelys trijuga						
	23.8	0(0)	2(100)	?/?		28
	25	7(23)	23(77)	?/?		
	27	15(56)	12(44)	?/?		
	30	1(3)	31(97)	?/?		
Rhinoclemmys areolata						
	25	6(100)	0(0)	?/?		28
	30	0(0)	6(100)	?/?		
Rhinoclemmys pulcherrima						
	25	14(100)	0(0)	?/?		28
	30	2(25)	6(75)	?/?		
Emydinae						
Chrysemys picta						
	25	81(100)	0(0)	102/?		11
	30.5	0(0)	81(100)	101/?		
	28.0	1(2)	40(98)	41/>10	Tennessee (TN)	13
	28.0	92(98)	2(2)	94/>25	Wisconsin (WI)	
	28.3	1(9)	10(91)	11/>10	TN	
	29.0	0(0)	12(100)	12/>10	TN	
	29.0	24(63)	14(37)	38/>25	WI	
	29.5	0(0)	5(100)	5/>10	TN	
	29.5	0(0)	7(100)	7/>25	WI	
	30.0	0(0)	16(100)	16/>10	TN	
	30.0	0(0)	56(100)	56/>25	WI	
	30.6	0(0)	14(100)	14/>10	TN	
	30.6	0(0)	22(100)	22/>25	WI	
	28.5	0(0)	?(100)	?/?		22
	31	0(0)	?(100)	?/?		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	26.0	7(100)	0(0)	?/7		23
	28.5	0(0)	16(100)	?/7		
	31.0	0(0)	18(100)	?/7		
	21.5	102(100)	0(0)	?/?	some feminization	28
	22.5	10(100)	0(0)	?/?		
	25	83(100)	0(0)	?/?		
	27	33(100)	0(0)	?/?		
	30	0(0)	78(100)	?/?		
	25	23(100)	0(0)	23/?		33
	31	0(0)	28(100)	28/?		
	26.5	19(100)	0(0)	19/?		36
	26.5	28(80)	7(20)	35/?		
	27	21(100)	0(0)	30/?	9 unsexable	
	27	6(43)	8(57)	18/?	4 unsexable	
	28.5	4(19)	17(81)	21/?		
	28.5	3(14)	18(86)	21/?		
	28.5	7(78)	2(22)	9/?		
	28.5	6(75)	2(25)	8/?		
	30.5	0(0)	37(100)	37/?		
	32	0(0)	14(100)	15/?	1 unsexable	
	22	6(35)	11(65)	40/21	1 unsexable	37
	27	21(100)	0(0)	31/21	9 unsexable	
	32	0(0)	14(100)	31/21	1 unsexable	
	25.7	41(100)	0(0)	45/24	-150 and -1100 kPa	68
	26.7	38(100)	0(0)	45/24	-150 and -1100 kPa	
	27.7	29(100)	0(0)	45/24	-150 and -1100 kPa	
	28.7	13(68)	6(32)	21/12	-150 kPa	
	28.7	7(50)	6(43)	24/12	-1100 kPa, 1 intersex	
	20	3(50)	3(50)	21/19		83
	22	14(100)	0(0)	20/19		
	24	17(100)	0(0)	21/19		
	26	18(100)	0(0)	21/19		
	28	3(19)	13(81)	21/19		
	30	0(0)	19(100)	21/19		
	32	0(0)	17(100)	21/19		
Clemmys guttata						
	22.5	10(91)	1(9)	?/?		28
	25	14(70)	6(30)	?/?		
	27	12(92)	1(8)	?/?		
	30	0(0)	19(100)	?/?		
Clemmys insculpta						
	25	6(33)	12(67)	18/6		10
	30	7(39)	11(61)	18/6		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	22.5	15(44)	19(56)	?/?		28
	25	19(44)	24(56)	?/?		
	27	15(44)	19(56)	?/?		
	30	24(53)	21(47)	?/?		
Clemmys muhlenbergii						
	25	1(33)	2(67)	?/?		28
Deirochelys reticularia						
	25	16(100)	0(0)	?/?		28
	30	2(11)	17(89)	?/?		
Emydoidea blandingii						
	22.5	40(100)	0(0)	?/?		28
	25	57(97)	2(3)	?/?		
	30	0(0)	63(100)	?/?		
	26.5	10(100)	0(0)	?/6		35
	31.0	0(0)	10(100)	?/6		
Emys orbicularis						
	30	1(4)	23(96)	24/?		71
	25	40(100)	0(0)	40/?		72
	29.5	0(0)	11(100)	11/?		
	27.5	25(100)	0(0)	25/?		73
	25	76(100)	0(0)	76/?		74
	27.5	25(100)	0(0)	25/?		
	29.5	0(0)	117(100)	117/?		
	27.75	30(100)	0(0)	30/?		75
	28.25	19(95)	1(5)	20/?		
	28.75	8(42)	11(58)	19/?		
	29.25	1(3)	29(94)	31/?	1 intersex	
	27.75	23(77)	0(0)	30/?	7 intersexes	76
	28.25	20(54)	4(11)	37/?	13 intersexes	
	28.75	6(18)	13(39)	33/?	14 intersexes	
	29.25	0(0)	29(94)	31/?	2 intersexes	
	29.75	0(0)	54(100)	54/?		
	18	8(100)	0(0)	8/?		77
	19.5	6(100)	0(0)	6/?		
	35	0(0)	10(100)	10/?		
	25.5	149(100)	0(0)	149/?		107
	28.75	6(16)	30(81)	37/?	1 intersex	
	30.25	0(0)	127(100)	127/?		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	28.5	1(11)	8(89)	9/1		108
	28.5	0(0)	10(100)	10/1		
	28.5	0(0)	5(63)	8/1	3 intersexes	
	28.5	4(80)	1(20)	6/1	1 embryo died	
	28.5	4(67)	1(17)	6/1	1 intersex	
	28.5	4(44)	1(11)	9/1	4 intersexes	
	28.5	2(18)	9(82)	11/1		
	28.5	1(14)	6(86)	7/1		
	28.5	5(83)	1(17)	7/1	1 egg unfertilized	
	28.5	1(10)	6(60)	10/1	3 intersexes	
Graptemys barbouri						
	25	9(100)	0(0)	?/?		28
	30	0(0)	9(100)	?/?		
Graptemys geographica						
	25	98(100)	0(0)	122/?		11
	30.5	0(0)	88(100)	119/?		
	28.0	26(100)	0(0)	26/7		13
	29.0	2(33)	4(67)	6/7		
	30.0	0(0)	28(100)	28/7		
	22.5	14(100)	0(0)	?/?		28
	25	33(100)	0(0)	?/?		
	27	22(100)	0(0)	?/?		
	30	0(0)	44(100)	?/?		
	33	0(0)	3(100)	?/?		
Graptemys kohnii						
	25	151(100)	0(0)	?/?		28
	30	0(0)	153(100)	?/?		
Graptemys nigrinoda						
	25	6(100)	0(0)	?/?		28
	30	0(0)	7(100)	?/?		
Graptemys ouachitensis						
	25	210(100)	0(0)	233/?		11
	30.5	0(0)	211(100)	237/?		
	29.25	3(30)	7(70)	10/1		12
	29.25	7(78)	2(22)	10/1		
	29.25	4(40)	6(60)	10/1		
	29.25	4(50)	3(38)	10/1	1 intersex	
	29.25	2(22)	7(78)	10/1		
	29.25	5(50)	4(40)	10/1	1 intersex	
	29.25	0(0)	9(100)	10/1		
	29.25	7(78)	2(22)	10/1		
	29.25	0(0)	10(100)	10/1		
	29.25	1(10)	9(90)	10/1		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	29.25	9(90)	0(0)	10/1	1 intersex	
	29.25	2(22)	7(78)	10/1		
	29.25	3(30)	7(70)	10/1		
	29.25	4(44)	5(56)	10/1		
	29.25	10(100)	0(0)	10/1		
	29.25	4(40)	6(60)	10/1		
	29.25	4(40)	5(50)	10/1	1 intersex	
	29.25	1(10)	9(90)	10/1		
	29.25	3(30)	6(60)	10/1	1 intersex	
	29.25	5(50)	5(50)	10/1		
	28.0	93(100)	0(0)	93/>25		13
	29.0	53(83)	11(17)	64/>25		
	30.0	1(1)	88(99)	89/>25		
	25	69(100)	0(0)	?/?		28
	30	0(0)	64(100)	?/?		
Graptemys pseudogeographica						
	25	173(100)	0(0)	222/?		11
	30.5	4(3)	147(97)	232/?		
	28.0	7(100)	0(0)	7/7	Tennessee (TN)	13
	28.0	70(100)	0(0)	70/9	Wisconsin (WI)	
	28.3	24(96)	1(4)	25/7	TN	
	28.3	14(100)	0(0)	14/9	WI	
	29.0	0(0)	5(100)	5/7	TN	
	29.0	22(92)	2(8)	24/9	WI	
	29.3	13(28)	34(72)	47/7	TN	
	29.3	33(58)	24(42)	57/9	WI	
	29.5	4(16)	21(84)	25/7	TN	
	29.5	5(33)	10(67)	15/9	WI	
	30.0	0(0)	5(100)	5/7	TN	
	30.0	9(11)	73(89)	82/9	WI	
	30.6	0(0)	22(100)	22/7	TN	
	30.6	0(0)	17(100)	17/9	WI	
	22.5	11(100)	0(0)	?/?		28
	25	16(100)	0(0)	?/?		
	30	0(0)	14(100)	?/?		
	33	0(0)	11(100)	?/?		
	25	54(100)	0(0)	66/17	Eggs from *ouachitensis*	92
	35	0(0)	17(100)	70/17	and *pseudogeographica*	
Graptemys pulchra						
	28.0	17(100)	0(0)	17/>10		13
	29.0	0(0)	4(100)	4/>10		
	30.0	0(0)	14(100)	14/>10		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
Malaclemys terrapin						
	24	20(100)	0(0)	?/?		28
	30	0(0)	34(100)	?/?		
	27	2(67)	1(33)	7/1	1972	82
	27	35(100)	0(0)	63/9	1973-1975	
	27	7(88)	1(12)	8/1	1977	
	27	8(100)	0(0)	9/1	1977	
Pseudemys concinna						
	22.5	13(100)	0(0)	?/?		28
	25	52(91)	5(9)	?/?		
	30	0(0)	55(100)	?/?		
Pseudemys floridana						
	25	4(100)	0(0)	?/?		28
	30	0(0)	4(100)	?/?		
Terrapene carolina						
	26.0	3(50)	3(50)	?/5		23
	28.5	2(40)	3(60)	?/5		
	31.0	1(14)	6(86)	?/5		
	21.5	13(93)	1(7)	?/?		28
	22.5	24(73)	9(27)	?/?		
	25	73(96)	3(4)	?/?		
	27	25(81)	6(19)	?/?		
	30	0(0)	84(100)	?/?		
Terrapene ornata						
	21.5	1(100)	0(0)	?/?		28
	22.5	14(100)	0(0)	?/?		
	25	8(100)	0(0)	?/?		
	29	0(0)	28(100)	31/9	2 unsexed	70
Trachemys scripta						
	28.0	21(100)	0(0)	21/>10	Alabama (AL)	13
	28.3	33(92)	3(8)	36/>10	Tennessee (TN)	
	29.0	6(38)	10(62)	16/>10	AL	
	29.5	12(30)	28(70)	40/>10	TN	
	30.0	0(0)	17(100)	17/>10	AL	
	30.6	2(5)	40(95)	42/>10	TN	
	21.5	3(100)	0(0)	?/?		28
	22.5	23(100)	0(0)	?/?		
	25	21(100)	0(0)	?/?		
	27	3(100)	0(0)	?/?		
	30	0(0)	20(100)	?/?		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
KINOSTERNIDAE						
Kinosternon flavescens						
	25	5(33)	10(67)	?/?		28
	27	13(93)	1(7)	?/?		
	30	10(91)	1(9)	?/?		
	32	0(0)	8(100)	?/?		
	25	11(79)	3(21)	29/10		94
	31	0(0)	16(100)	27/10		
	25	?(79)	?(21)	?/?	*K. flavescens*?	6
	31	0(0)	?(100)	?/?		
Kinosternon leucostomum						
	22.5	1 or 2(19)	6 or 7(81)	?/?		28
	24	1(100)	0(0)	?/?		
	25	3(75)	1(25)	?/?		
	27	0(0)	6(100)	?/?		
	30	0(0)	9(100)	?/?		
Kinosternon scorpioides						
	22.5	8(22)	14(78)	?/?		28
	24	25(82)	6(18)	?/?		
	25	53(81)	12(19)	?/?		
	27	23(70)	10(30)	?/?		
	30	0(0)	73(100)	?/?		
Kinosternon subrubrum						
	22.5	1(17)	5(83)	?/?		28
Sternotherus carinatus						
	22.5	0(0)	5(100)	?/?		28
	25	1(20)	4(80)	?/?		
	27	6(100)	0(0)	?/?		
	30	0(0)	6(100)	?/?		
Sternotherus minor						
	22.5	1(4)	27(96)	?/?		28
	24	1(8)	11(92)	?/?		
	25	22(76)	7(24)	?/?		
	27	1(6)	17(94)	?/?		
	30	0(0)	36(100)	?/?		
	32	0(0)	3(100)	?/?		
Sternotherus odoratus						
	21.5	0(0)	14(100)	?/?		28
	22.5	0(0)	59(100)	?/?		
	23.8	8(31)	18(69)	?/?		
	25	46(94)	3(6)	?/?		
	27	6(23)	20(77)	?/?		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	30	0(0)	51(100)	?/?		
	23.5	6(19)	26(81)	34/20		94
	25	27(82)	6(18)	34/20		
	28	2(3)	68(97)	92/58		
	29.5	2(3)	56(97)	58/38		
	30.5	1(2)	40(98)	69/58		
STAUROTYPIDAE						
Staurotypus salvinii						
	22.5	1(25)	4(75)	?/?	from 1 female	28
	22.5	18(100)	0(0)	?/?	from 3 females	
	25	8(53)	7(47)	?/?	from 1 female	
	25	19(100)	0(0)	?/?	from 3 females	
	27	3(60)	2(40)	?/?	from 1 female	
	27	14(100)	0(0)	?/?	from 3 females	
	30	3(33)	6(67)	?/?	from 1 female	
	30	7(78)	2(22)	?/?	from 3 females	
Staurotypus triporcatus						
	22.5	11(44)	14(56)	?/?		28
	25	17(55)	14(45)	?/?		
	27	12(40)	18(60)	?/?		
	30	8(53)	7(47)	?/?		
TESTUDINIDAE						
Testudo graeca						
	26.5	19(100)	0(0)	19/?		71
	30	22(96)	1(4)	23/?		
	31	0(0)	20(100)	20/?		72
	33	0(0)	20(100)	20/?		
	26.5	19(100)	0(0)	19/?		74
	29.5	37(97)	1(3)	38/?		
	31.5	0(0)	16(100)	16/?		
Testudo hermanni						
	~23.5	6(100)	0(0)	6/1		26
TRIONYCHIDAE						
Trionyx muticus						
	27	23(44)	29(56)	?/?		28
	30	26(49)	27(51)	?/?		
	33	30(54)	25(46)	?/?		
Trionyx spiniferus						
	31	7(50)	7(50)	51/?		9

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	25	33(49)	34(51)	83/?		11
	30.5	27(53)	24(47)	86/?		
	23	7(41)	10(59)	68/?	51 unsexed	93
	25	34(49)	35(51)	86/?	17 unsexed	
	28	29(52)	27(48)	69/?	13 unsexed	
	30.5	28(53)	25(47)	89/?	36 unsexed	
	33	21(41)	30(59)	66/?	15 unsexed	
PLEURODIRA						
CHELIDAE						
Chelodina longicollis						
	24	7(35)	13(65)	25/15	5 unsexed	31
	26	4(36)	7(64)	13/13	2 unsexed	
	28	4(31)	9(69)	13/13		
	30	6(35)	11(65)	18/15	1 unsexed	
	32	14(64)	11(36)	27/15	1 unsexed	
Emydura macquarii						
	20	1(33)	2(67)	6/1	Eggs at 20° were switched to 30° after 91 days	85,86
	~25	13(65)	7(35)	24/8		
	26	7(37)	12(63)	24/8		
	28	10(50)	10(50)	24/8		
	30	18(78)	5(22)	24/8		
	30	58(52)	53(48)	?/?		
	32	10(56)	8(44)	24/8		
Emydura signata						
	25	15(45)	18(55)	33/12		10
	28	3(25)	9(75)	12/12		
	30	13(65)	7(35)	20/12		
PELOMEDUSIDAE						
Pelomedusa subrufa						
	24	0(0)	2(100)	?/?		28
	25	0(0)	11(100)	?/?		
	27	0(0)	17(100)	?/?		
	30	12(71)	5(29)	?/?		
	33	0(0)	9(100)	?/?		
Pelusios castaneus						
	25	0(0)	11(100)	?/?		28
	27	0(0)	3(100)	?/?		
	30	14(82)	3(18)	?/?		
	33	0(0)	5(100)	?/?		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
CROCODYLIA						
ALLIGATORIDAE						
Alligator mississippiensis						
	32	12(100)	0(0)	46/?		9
	26	0(0)	10(100)	50/13		29,30
	28	0(0)	96(100)	100/13		
	30	0(0)	97(100)	100/13		
	32	13(13)	85(87)	100/13		
	34	94(100)	0(0)	100/13		
	36	7(100)	0(0)	50/13		
	29.4	0(0)	90(100)	113/11		44,45
	30.6	13(41)	19(59)	42/11		
	31.7	41(75)	14(25)	67/11		
	32.8	111(99)	1(1)	135/11		
	30	0(0)	?(100)	?/?		48
Caiman crocodilus						
	28.5	0(0)	?(100)	?/?		49
	~28.9	0(0)	?(100)	?/?		
	~30.1	0(0)	?(100)	?/?		
	~30.9	0(0)	?(100)	?/?		
	~31.4	?(~60)	?(~40)	?/?		
	~31.9	?(100)	0(0)	?/?		
	~32.3	?(100)	0(0)	?/?		
	33.0	?(100)	0(0)	?/?		
	33.5	?(100)	0(0)	?/?		
Paleosuchus trigonatus						
	≤31	0(0)	?(100)	?/?		101
	32	?(100)	0(0)	?/?		
CROCODYLIDAE						
Crocodylus johnsoni						
	28.0	0(0)	4(100)	?/?	Incubation method A	96
	29.0	0(0)	31(100)	?/?	A & B	
	30.0	0(0)	48(100)	?/?	A & B	
	31.0	0(0)	9(100)	?/?	A	
	31.0	2(13)	14(87)	?/?	B	
	31.5	7(23)	24(77)	?/?	B	
	31.7	5(25)	15(75)	?/?	A	
	32.0	4(31)	9(69)	?/?	A	
	32.0	0(0)	14(100)	?/?	B	
	32.5	6(23)	20(77)	?/?	A	
	32.5	0(0)	6(100)	?/?	B	
	33.0	0(0)	27(100)	?/?	A & B	

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	34.0	0(0)	9(100)	?/?	A	
	26	0(0)	12(100)	122/?		97
	27.9	0(0)	15(100)	44/?		
	29.9	0(0)	48(100)	70/?		
	30	5(19)	21(81)	41/?	1 clutch gave 12 females, 2 dead	
	30	1(1)	123(99)	176/?	The male was deformed	
	31.1	3(13)	20(87)	28/?		
	31.7	0(0)	5(100)	6/?		
	32.0	0(0)	13(100)	26/?		
	32.0	6(30)	14(70)	33/?		
	34	0(0)	41(100)	131/?	Most dead	
	32	5(29)	12(71)	?/?		99
	33	5(20)	20(80)	?/?		
Crocodylus niloticus						
	27.83	0(0)	82(100)	98/9		41
	30.96	0(0)	94(100)	118/10		
	32.5	10(91)	1(9)	18/1		
	33.83	53(100)	0(0)	60/6		
	33.83	9(82)	2(18)	18/1		
	33.83	6(75)	2(25)	8/1		
	33.83	11(85)	2(15)	13/1		
	33.83	3(33)	6(67)	13/1		
Crocodylus palustris						
	28	0(0)	27(100)	?/6	>90% hatching in all treatments except for 33.5° and 34°	49
	28.5	0(0)	35(100)	?/4		
	29	0(0)	32(100)	?/6		
	29.5	0(0)	22(100)	?/4		
	30	0(0)	46(100)	?/8		
	30.5	0(0)	17(100)	?/3		
	31	0(0)	51(100)	?/6		
	31.5	2(22)	7(78)	?/1		
	32	7(70)	3(30)	?/1		
	32	2(25)	6(75)	?/1		
	32	9(69)	4(31)	?/1		
	32	1(100)	0(0)	?/1		
	32.5	8(100)	0(0)	?/1		
	33	3(21)	11(79)	?/1		
	33	3(75)	1(25)	?/1		
	33	3(27)	8(73)	?/1		
	33.5	0(0)	0(0)	19/?		
	34	0(0)	0(0)	4/?		
Crocodylus porosus						
	30	0(0)	?(100)	?/?		46
	32	?(100)	0(0)	?/?		
	28.0	0(0)	4(100)	?/?	Incubation method A	96

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	29.0	0(0)	26(100)	?/?	B	
	30.0	0(0)	70(100)	?/?	A & B	
	31.0	1(50)	1(50)	?/?	A	
	31.0	2(12)	15(88)	?/?	B	
	32.0	10(91)	1(9)	?/?	A	
	32.0	52(85)	9(15)	?/?	B	
	33.0	4(100)	0(0)	?/?	A	
	33.0	1(4)	25(96)	?/?	B	
Crocodylus siamensis						
	28	0(0)	?(100)	?/?		47
	32.5	?(100)	0(0)	?/?		
	27.75	0(0)	11(100)	11/1		48
	33.0	14(100)	0(0)	14/1		
SQUAMATA						
LACERTILIA						
AGAMIDAE						
Agama agama						
	26.5	1(2)	45(98)	?/?		19
	29	30(100)	0(0)	?/?		
Agama caucasia						
	27	21(72)	8(28)	44/5		50
	28	19(95)	1(5)	20/2		
ANGUIDAE						
Elgaria multicarinatus						
	27.5	?(>50)	?(<50)	?/?		51
GEKKONIDAE						
Eublepharis macularius						
	26	0(0)	20(100)	20/?		7,8
	32.5	24(80)	6(20)	30/?		
	29.5	?(50)	?(50)	?/?		8
	31.5	16(84)	3(16)	19/?		9
	31.5	13(93)	1(7)	24/?		
	26.7	?(0)	?(100)	?/?		58
	32.2	?(100)	?(0)	?/?		
	27	?(<<50)	?(>>50)	?/?		87

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	24	0(0)	7(100)	10/?		95
	27.85	1(2)	44(98)	59/?		
	32.7	14(88)	2(12)	18/?		
Gekko japonicus						
	20	0(0)	0(0)	20/?		88,89,90
	24	1(7)	13(93)	26/?		
	26	4(22)	19(78)	?/?		
	28	15(75)	5(25)	30/?		
	30	4(22)	19(78)	?/?		
	32	5(24)	16(76)	35/?		
Hemitheconyx caudicinctus						
	28.6	?(0)	?(100)	?/?		1
	31.7	?(100)	?(0)	?/?		
	26.7	?(0)	?(100)	?/?		58
	32.2	?(100)	?(0)	?/?		
	??	0(0)	?(100)	?/?		95
Tarentola boettgeri						
	28.5	0(0)	23(100)	?/?		65
Tarentola mauritanica						
	28.5	0(0)	33(100)	?/?		65
IGUANIDAE						
Anolis carolinensis						
	24	?(~50)	?(~50)	?/?		91
	25	?(~50)	?(~50)	?/?		
	27	?(~50)	?(~50)	?/?		
	28	?(~50)	?(~50)	?/?		
	30	?(~50)	?(~50)	?/?		
	32	?(~50)	?(~50)	?/?		
	34	?(~50)	?(~50)	?/?		
Dipsosaurus dorsalis						
	28	1(50)	1(50)	11/?		64
	30	6(35)	11(65)	22/?		
	32	6(46)	7(54)	16/?		
	34	12(75)	4(25)	21/?		
	35	0(0)	4(100)	4/?		
	36	38(49)	41(51)	94/?		
	38	7(32)	15(68)	22/?		
	40	0(0)	3(100)	4/?		
Sceloporus jarrovi						
	26	14(37)	24(63)	?/?		3
	28	28(70)	12(30)	?/?		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	30	40(50)	40(50)	?/?		
	32	51(49)	53(51)	?/?		
	34	46(46)	54(54)	?/?		
	36	34(65)	18(35)	?/?		
Sceloporus undulatus						
	30	19(53)	17(47)	37/8		81
	24	?(~50)	?(~50)	?/?		91
	25	?(~50)	?(~50)	?/?		
	27	?(~50)	?(~50)	?/?		
	28	?(~50)	?(~50)	?/?		
	30	?(~50)	?(~50)	?/?		
	32	?(~50)	?(~50)	?/?		
	34	?(~50)	?(~50)	?/?		
LACERTIDAE						
Lacerta viridis						
	29	?(~50)	?(~50)	?/?		27
	17.5	6(67)	3(33)	23/~3	First 5-7 days at 25 C	78
	19.5	4(57)	3(43)	24/~3	First 13 days at 25 C	
	35.5	11(55)	9(45)	?/3	First 5-6 days at 25 C	
	35.5	4(33)	8(67)	?/2	First 13-14 days at 25 C	
Podarcis pityusensis						
	29	?(~8)	?(~92)	?/?	97% hatch success	27
TEIIDAE						
Cnemidophorus inornatus						
	25	12(55)	10(45)	22/?		20
	30	10(50)	10(50)	20/?		
Cnemidophorus uniparens						
	25	0(0)	78(100)	78/?	parthenogenetic	20
	26	0(0)	32(100)	32/?		
	29	0(0)	52(100)	52/?		
	30	0(0)	38(100)	38/?		
	31	0(0)	44(100)	44/?		
	33	0(0)	0(0)	5/?		
SERPENTES						
COLUBRIDAE						
Boiga dendrophila						
	29.25	4(50)	4(50)	9/1		2
	30	3(60)	2(40)	7/1		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
Cemophora coccinea						
	25	5(71)	2(29)	7/1		5
Clelia clelia						
	27	6(67)	3(33)	10/1		55
Coluber constrictor						
	26.5	7(78)	2(22)	14/1		32
Nerodia fasciata						
	21.65	99(55)	81(45)	?/10		67
	26.4	135(48)	144(52)	?/12		
	30.0	101(46)	119(54)	?/11		
Pituophis melanoleucus						
	21	1(11)	8(89)	19/?	Moved to 23° after 70 days	14
	23	20(35)	37(65)	73/?	Sexed embryos excluded	
	23	24(41)	35(59)	66/?		
	26	17(46)	20(54)	43/?		
	28	34(50)	34(50)	73/?		
	28	47(49)	49(51)	97/?		
	30	18(47)	20(53)	39/?		
	32	28(58)	20(42)	62/?		
	33	31(55)	25(45)	64/?		
Xenocalamus bicolor						
	31	2(50)	2(50)	4/1		4
ELAPIDAE						
Acanthophis antarcticus						
	29	9(45)	11(55)	20/1		39
	29	8(42)	11(58)	19/1		
	29	9(47)	10(53)	19/1		
	29	12(50)	12(50)	25/1		
	29	8(40)	12(60)	20/1		
	29	10(48)	11(52)	21/1		
	29	10(43)	13(57)	23/1		
	29	8(47)	9(53)	17/1		
Pseudechis australis						
	28	11(79)	3(21)	15/1		16
	27	6(55)	5(45)	15/1	Female #1	59
	27	8(67)	4(33)	14/1	"	
	27	9(90)	1(10)	12/1	Female #2	
Pseudechis colletti						
	28	13(81)	3(19)	18/1		16
	28	4(36)	7(64)	12/1		

Taxa	Temp (C)	# ♂♂ (%)	# ♀♀ (%)	# eggs/# clutches	Comments	Source
	28.5	2(40)	3(60)	7/1		18
Pseudechis guttatus						
	28	5(50)	5(50)	10/1		16
	28	5(63)	3(37)	8/1		
Pseudolaticauda semifasciata						
	28	51(61)	32(39)	114/29		66
PYTHONIDAE						
Aspidites melanocephalus						
	30	2(25)	6(75)	8/1		17
Morelia amethistina						
	30	3(43)	4(57)	7/1		17
Morelia spilota						
	30	11(52)	10(48)	23/1		17
	30	5(100)	0(0)	7/1		
VIPERIDAE						
Crotalus vegrandis						
	28	5(63)	3(37)	8/1		15

SOURCES--1: Anderson and Oldham (1988), 2: Bakken and Bakken (1988), 3: Beuchat (1988), 4: Branch and Patterson (1976), 5: Braswell and Palmer (1984), 6: Bull (1980), 7: Bull (1987a), 8: Bull (1987b), 9: Bull et al. (1988), 10: Bull et al. (1985), 11: Bull and Vogt (1979), 12: Bull et al. (1982a), 13: Bull et al. (1982b), 14: Burger and Zappalorti (1988), 15: Carl et al. (1982), 16: Charles (1988), 17: Charles et al. (1985), 18: Charles et al. (1983), 19: Charnier (1966), 20: Crews (1989), 21: Crews et al. (1989), 22: Dimond (1979), 23: Dimond (1983), 24: Dimond and Mohanty-Hejmadi (1983), 25: Dutton et al. (1985), 26: Ehrengart (1971), 27: Eichenberger (1981), 28: Ewert and Nelson (in press), 29: Ferguson and Joanen (1982), 30: Ferguson and Joanen (1983), 31: Georges (1988), 32: Gillingham (1976), 33: Gutzke and Bull (1986), 34: Gutzke and Chymiy (1988), 35: Gutzke and Packard (1987), 36: Gutzke and Paukstis (1983), 37: Gutzke and Paukstis (1984), 38: Harry and Limpus (1989), 39: Hay and Magnusson (1986), 40: Hou (1985), 41: Hutton (1987), 42: Janzen (1987), 43: Janzen et al. (in press), 44: Joanen and McNease (1989), 45: Joanen et al. (1987), 46: Joss and Cuff (1987), 47: Lang (1985), 48: Lang (1987), 49: Lang et al. (1989), 50: Langerwerf (1983), 51: Langerwerf (1984), 52: Lescure et al. (1985), 53: Limpus et al. (1983), 54: Limpus et al. (1985), 55: Martinez and Cerdas (1986), 56: McCoy et al. (1983), 57: Miller and Limpus (1981), 58: Miller (1979), 59: Mirtschin (1988), 60: Mohanty-Hejmadi et al. (1985), 61: Mohanty-Hejmadi and Dimond (1986), 62: Mrosovsky (1988), 63: Mrosovsky et al. (1984), 64: Muth and Bull (1981), 65: Nakamoto and Toriba (1986), 66: Nettmann and Rykena (1985), 67: Osgood (1978), 68: Packard et al. (1989), 69: Packard et al. (1984), 70: Packard et al. (1985), 71: Pieau (1971), 72: Pieau (1972). 73: Pieau (1973), 74: Pieau (1975a), 75: Pieau (1975b), 76: Pieau (1976), 77: Pieau (1978), 78: Raynaud and Pieau (1972), 79: Rimblot et al. (1985), 80: Rimblot-Baly et al. (1987), 81: Roggenbuck and Jenssen (1986), 82: Sachsse (1984), 83: Schwarzkopf and Brooks (1985), 84: Standora and Spotila (1985), 85: Thompson (1983), 86: Thompson (1988), 87: Thorogood and Whimster (1979), 88: Tokunaga (1985), 89: Tokunaga (1986), 90: Tokunaga (1989), 91: Viets

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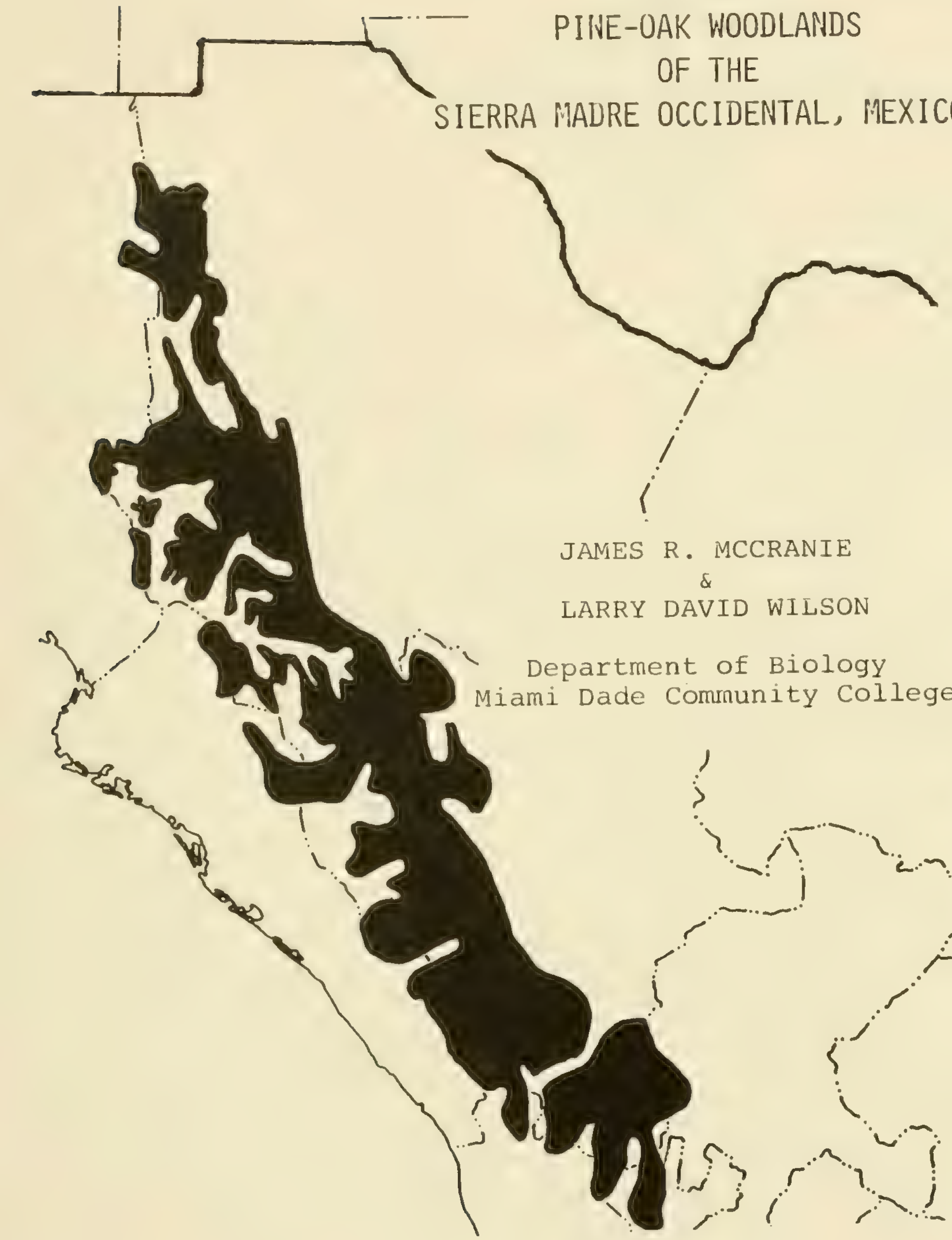

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INTRODUCTION

This bibliography is a result of a literature search which helped form the foundation for our study entitled "The biogeography of the herpetofauna of the pine-oak woodlands of the Sierra Madre Occidental of Mexico" Milwaukee Pub. Mus. Contrib. Biol. Geol. (72):1-30, 1987.

The bibliography includes all references known to the authors that contain bonafide records of the occurrence of amphibians and reptiles in the pine-oak woodlands of the Sierra Madre Occidental of Mexico. The reader is referred to that study for a definition of the limits of the study area.

The 86 species included in the study and their literature citatations are presented below in alphabetical order within their respective orders. We believe this bibliography (188 references) to be relatively complete through the year 1986. In addition, six later references are included in a addendum.

We wish to extend our sincere gratitude to Joy-Ann Perard for her typing of the manuscript. It was a time-consuming task, and we much appreciate her help.

SPECIES LIST

Class Amphibia

Order Caudata

Ambystoma rosaceum 3, 5, 6, 28, 38, 48, 63, 79, 86, 94, 113, 114, 149, 159 (also as tigrinum), 160 (as tigrinum), 175, 176, 177, 179, 190.

Ambystoma tigrinum 28, 113, 175.

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Order Salientia

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Bufo woodhousei 160.

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Eleutherodactylus tarahumaraensis 142, 147, 175, 186

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Hyla bistincta 40, 175.

Hyla eximia 3, 40, 42, 56, 63, 69, 73, 79, 131, 133, 160, 175, 176, 177, 179, 186.

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Rana tarahumarae 18, 19, 35, 61, 62, 73, 79, 94, 131, 177, 185, 188.

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Kinosternon sonoriense 65, 66, 68, 129, 194.

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Suborder Sauria

Anolis nebulosus 38, 57, 94, 175, 176, 194.

Barisia imbricata 38, 55, 121, 132, 157, 158, 175, 176, 189.

Barisia levicollis 55, 132, 157, 194.

Cnemidophorus costatus 57, 94, 152 (as perplexus), 175, 187.

Cnemidophorus exsanguis 20, 41, 160, 194.

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Eumeces lynxe 38, 82, 100, 137, 167, 175.

Eumeces multilineatus 2 (as multivirgatus), 7 (as multivirgatus), 82, 95, 136, 194 (also as multivirgatus).

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Eumeces parvulus 57, 107.

Eumeces tetragrammus 79, 82, 83, 94, 107, 142, 146, 152, 194.

Gerrhonotus liocephalus 57, 175, 176, 178.

Phrynosoma douglassii 98, 160.

Phrynosoma orbiculare 12, 38, 42, 56, 64, 93, 97, 98, 105, 118, 121, 132, 144, 152, 160, 175, 194.

Sceloporus bulleri 45, 57, 87 (as torquatus), 166, 175, 176, 184.

Sceloporus clarkii 11, 57, 94, 144, 175, 194.

Sceloporus grammicus 2, 7, 12, 17, 21, 24, 35, 38, 54, 56, 79, 115, 120, 152, 160, 175, 176, 177, 194.

Sceloporus heterolepis 15, 17, 57, 78, 120, 168, 174, 175.

Sceloporus jarrovii 2, 7, 12, 17, 23, 33, 35, 38, 42, 54, 56, 57, 79, 94, 117, 120, 152, 160, 175, 176, 177, 178, 184, 194.

Sceloporus nelsoni 57, 94, 175.

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Sceloporus scalaris 4, 27, 35, 38, 54 (as *aeneus*), 79, 114, 116, 120, 127, 154, 160, 175, 194.

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Sceloporus torquatus 117.

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Suborder Serpentes

Adelophis foxi 109, 110, 175.

Coluber constrictor 125, 175, 181, 182.

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Crotalus basiliscus 8, 57, 92, 175.

Crotalus lepidus 8, 16, 38, 53, 57, 58, 60, 76, 79, 88, 124, 142, 143, 151, 160, 175, 184.

Crotalus molossus 8, 35, 38, 53, 76, 77, 103, 124, 142, 152, 160, 175, 176.

Crotalus pricei 1, 8, 24, 32, 35, 38, 42, 53, 76, 77, 91, 118, 124, 142, 152, 160, 175, 176, 177.

Crotalus scutulatus 104, 160.

Crotalus stejnegeri 29, 76, 77.

Thamnophis melanogaster 30, 38, 109, 112, 122, 138, 142, 175.

Thamnophis nigronuchalis 30 (as rufipunctatus [part]), 122 (as rufipunctatus [part]), 142, 155 (also as rufipunctatus [part]), 175.

Thamnophis rufipunctatus 122 (part), 124, 128, 138, 142, 150, 152, 155 (part), 160, 177.

Trimorphodon tau None. Our record based upon LSUMZ 35157 collected in Nayarit at 22.4 mi SW Las Canoas, Durango at 2370 m.

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